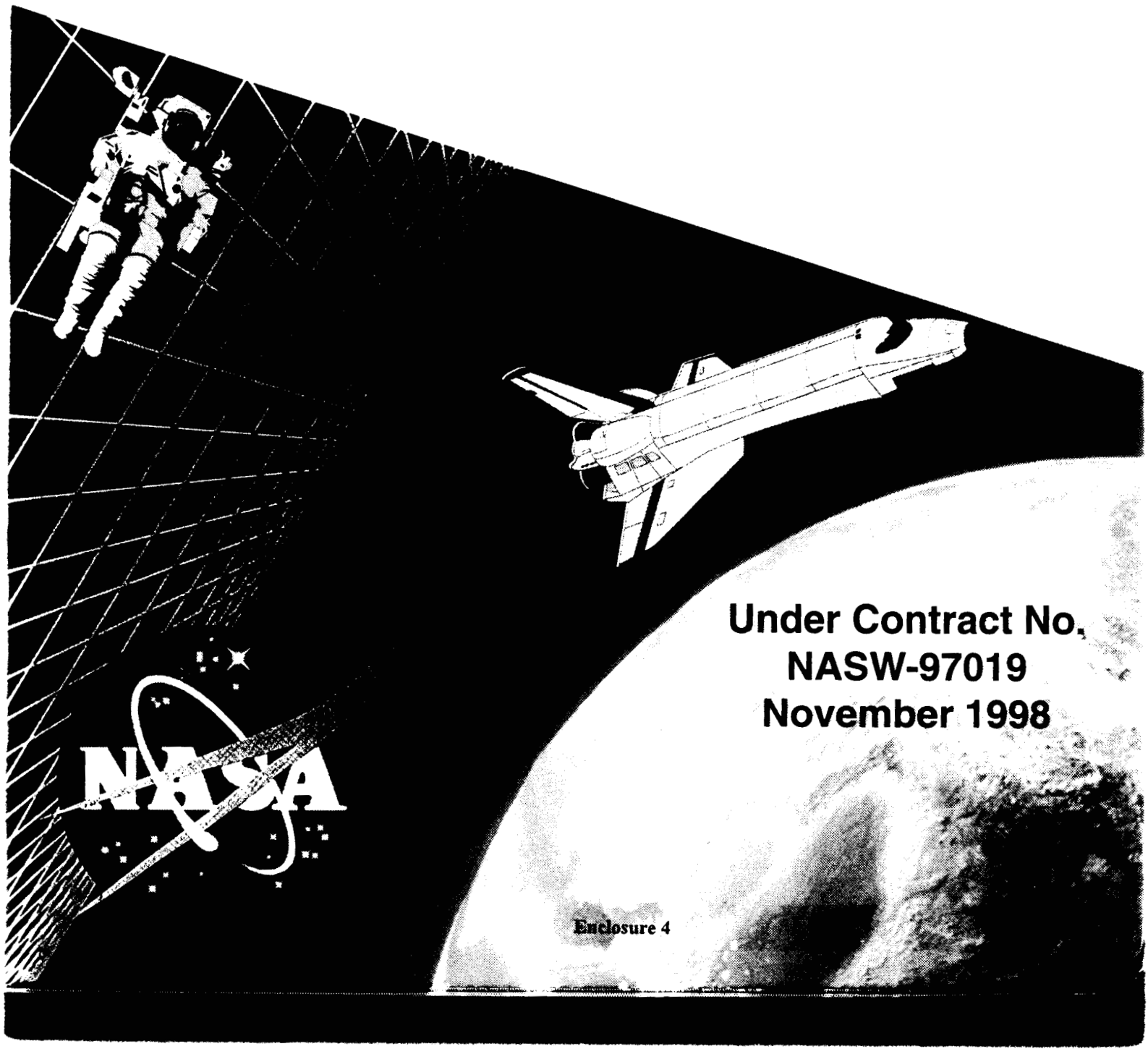
ENVIRONMENTAL MANAGEMENT DIVISION
ISO 14000 BUSINESS CASE



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2. Executive Summary

Introduction

Environmental managers are increasingly recognizing that having an integrated environmental management system (EMS) provides a sensible business approach and framework for promoting environmental systems and process integration. An EMS contributes to achieving efficiencies and streamlined operations and establishes a model for consistency and continual improvement for managing environmental affairs.

Government agencies can use an EMS as an effective means for meeting the Agency's goals with respect to the National Performance Review guidelines, the Government Performance and Results Act, and other initiatives to promote best business practices in the Federal arena.

ISO 14001 provides a model for an EMS that is receiving strong recognition both in the United States and internationally. Since 1996, when ISO 14001 was first published, there has been mounting evidence that managers in the United States are moving toward implementing ISO 14001. As described in Appendix A, this evidence includes such factors as:

- A 1,000% increase in the number of ISO 14001 registrations in the United States between July 1997 and July 1998.
- Fortune 500 companies, recognized in recent years for their significant cost cutting efforts, are adopting ISO 14001. These companies include IBM, Motorola, Ford Motor Company, Lucent Technologies, Monsanto, and Xerox to name a few.
- Other government agencies like the Departments of Defense (DoD) and Energy (DOE) have begun adopting ISO 14001.

Summary of Findings

This Business Case objectively examines the question of whether or not NASA should consider implementing an ISO 14001 EMS on an Agency-wide basis.

In order to develop the Business Case, an ISO 14001 gap analysis was performed at each NASA Center and Component Facility (except JPL). These analyses were performed to ascertain the compatibility of current management processes with ISO 14001 standards. During the conduct of the gap analyses, it became clear that NASA has had excellent environmental management controls in place for several years. As a result, it is the opinion of the developers of this Business Case, that NASA is already accomplishing over 80% of the activities required for an EMS.

The developers of this Business Case also conducted benchmark studies (at IBM, Ford, Lockheed Martin, AlliedSignal, and DOE Savannah River) in order to assess how other organizations are implementing ISO 14001, the costs that were incurred in doing so, as well as the benefits that were derived from implementing ISO 14001. The benchmark companies utilized one of the three following models:

3. Business Case

3.1 INTRODUCTION

3.1.1 Purpose

This report provides a detailed analysis to facilitate NASA's decision with respect to implementation of ISO 14001 on an Agency-wide basis.

3.1.2 What is ISO 14001?

ISO 14001 was first published by the International Organization for Standardization in 1996. It provides an internationally agreed upon set of minimum requirements for the management of environmental programs. Evidence of ISO 14001 conformance is provided through a third-party registration system for those organizations that choose to certify to the standard. The organization agreeing to certify to ISO 14001 hires an accredited Registrar to certify their EMS meets the ISO 14001 standard.

Sections of ISO 14001 include Environmental Policy, Planning, Implementation and Operation, Checking and Corrective Action, and Management Review. Figure 3.1.2-1 provides a pictorial representation of how the sections and elements fit together.

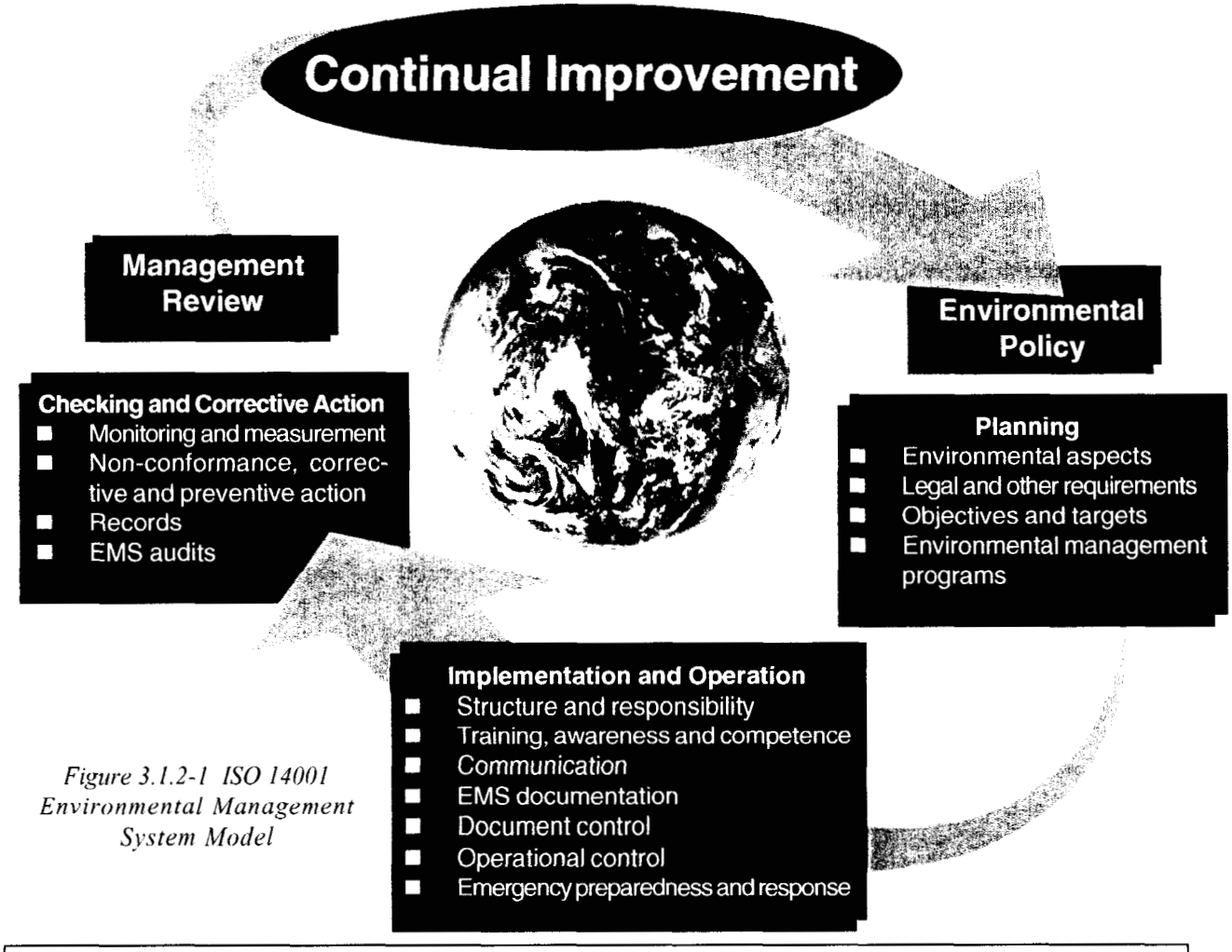

Figure 3.1.2-1 ISO 14001 Environmental Management System Model

Elements of the ISO 14001 requirements include:

- ➜ Writing and disseminating an Environmental Policy.
- ➜ Identifying Significant Environmental Aspects, i.e. those elements of an organization's activities, products or services that significantly interact with the environment.
- ➜ Identifying and accessing legal and other requirements that the organization subscribes to.
- ➜ Setting objectives and targets for improvement and pollution prevention.
- ➜ Establishing and maintaining programs to meet the objectives and targets.
- ➜ Providing necessary resources and responsibilities for the EMS.
- ➜ Providing training, as necessary, for the EMS.
- ➜ Establishing and maintaining procedures for the transmission of internal and external communications with respect to the EMS.
- ➜ Describing the core elements of the EMS in a clear manner that provides direction to the key documents in the system.
- ➜ Controlling documents required under the EMS.
- ➜ Establishing and maintaining procedures for operational controls necessary to maintain environmental performance within requirements.
- ➜ Communicating relevant procedures and requirements to suppliers and contractors.
- ➜ Establishing and maintaining emergency preparedness procedures.
- ➜ Establishing and maintaining procedures for monitoring and measuring key characteristics of the organization's operations and activities.
- ➜ Calibrating monitoring and measuring equipment.
- ➜ Evaluating compliance with relevant environmental laws and regulations.
- ➜ Establishing and maintaining procedures for taking corrective and preventive actions.
- ➜ Maintaining records.
- ➜ Conducting audits of the EMS.
- ➜ Conducting management reviews of the EMS.

Most NASA Centers and Component Facilities are addressing these elements in one form or another. In fact, as the gap analysis reports show, NASA is already implementing most of the ISO 14001 requirements.

Table 3.1.2-1 provides some examples of the documentation that NASA currently uses to address these elements. The table also identifies common elements between ISO 14001 and ISO 9001. Since NASA Centers and Component Facilities are currently working toward ISO 9001 certification, utilizing the same procedures for ISO 14001 will result in less cost, as well as less duplication of paperwork and activities.

Table 3.1.2-1 NASA Documents Addressing ISO 14001

Element of ISO 14001	ISO 9000 Element	Typical NASA Documents Addressing the Element
Policy	X	Environmental Policy is defined by HQ and issued by the Administrator. It applies on an Agency-wide basis. Site-Specific policies are neither required nor expected.
Environmental Aspects		No procedures exist to address Significant Aspects at this time
Legal and Other Requirements		Environmental Resource Document
Objectives and Targets		Pollution Prevention Plans Stormwater Pollution Prevention Plans Hazardous Waste Minimization Plans Environmental Justice Plans
Environmental Management Programs		Pollution Prevention Plans Stormwater Pollution Prevention Plans Hazardous Waste Minimization Plans Environmental Justice Plans
Structure and Responsibility	X	Individual Center's and Component Facility's Management Instructions
Training, Awareness, and Competence	X	Individual Centers and Component Facilities individually address this element as required by laws and regulations
Communication		Community Relations Plans for Superfund Sites Environmental Justice Plans NEPA Review Process for an EIS

Table 3.1.2-1 NASA Documents Addressing ISO 14001

Element of ISO 14001	ISO 9000 Element	Typical NASA Documents Addressing the Element
EMS Documentation	X	Only White Sands Test Facility has addressed this element
Document Control	X	To be implemented through the ISO 9001 Quality Management System
Operational Control	X	Individual procedures at each Center and Component Facility Contracts and Purchase Orders
Monitoring and Measurement	X	Compliance audits and surveillances ISO 9000 procedures for calibrating measuring and test equipment Individual monitoring procedures at each Center and Component Facility
Nonconformance, Corrective, and Preventive Action	X	To be implemented through the ISO 9001 Quality Management System
Records	X	To be implemented through the ISO 9001 Quality Management System NASA Uniform Files Index NPG 1441.1C NASA Records Retention Schedules
EMS Audits	X	EPA Protocol Audits include auditing the management system. Audits will need to be modified to specifically address the elements of ISO 14001.
Management Review	X	EPA Protocol Audits include a management review element.

3.2 Background and Assumptions

3.2.1 How the Business Case Was Developed

The Business Case was developed by performing a gap analysis at each NASA Center and Component Facility (except JPL). The gap analysis was an evaluation of each Center or Component Facility's current environmental management practices against the ISO 14001 standard.

The gap analysis report for each Center and Component Facility is presented in Appendix B of this Business Case. Several assumptions were made in the conduct of the gap analyses, and these assumptions are discussed in Section 3.2.2.

The Business Case also includes the experiences of other organizations, both public and private. Benchmark studies were conducted of five organizations at six separate locations. These benchmark studies focused on the models developed, resources involved in implementing ISO 14001, strategies taken, and benefits received. The report of these benchmark studies was issued under separate cover and is identified in the References section of this Business Case.

3.2.2 Gap Analysis Assumptions

Execution of the gap analyses involved performing a qualitative analysis of each line item of ISO 14001. This analysis is explained further in Appendix B. The following assumptions were made in conducting the gap analysis at each Center and Component Facility:

ISO 14001 Element No. 4.2:

Environmental Policy

Each Center was considered to have an environmental policy. This is because the environmental policy is established for the Agency by NASA Headquarters and is issued by the Administrator. Therefore, the Center or Component Facility gap analysis will reflect the results of reviewing the Agency-wide policy.

ISO 14001 Element No.4.3.1:

Environmental Aspects

The term environmental aspects is a unique term to ISO 14001, and it is not used anywhere else in the environmental industry. For this reason, it was assumed, and proven true, that the specific ISO 14001 requirement to have a procedure for addressing environmental aspects, was not addressed by any Center or Component Facility, except White Sands Test Facility that had committed to ISO 14001 at the time of the gap analysis.

ISO 14001 Element No. 4.3.3:

Objectives and Targets

ISO 14001 requires that the organization's significant aspects (reference Section 3.1.2 for the definition of significant aspects) be considered in the development of objectives and targets. Because NASA has not yet identified its significant aspects, this element cannot be fully met. However, objectives and targets have been set both Agency-wide and at individual Centers and Component Facilities. It was assumed in this analysis that, although they may not be documented as such, the environmental managers at NASA do know their significant environmental aspects. For that reason, little change is anticipated once the formal analysis of environmental aspects, under ISO 14001, has been accomplished. Therefore, this element is partially met in most cases.

ISO 14001 Element No. 4.4.1:

Structure and Responsibility

Because no commitment has been made to ISO 14001, it was assumed that no management representatives have been assigned for the ISO 14001 EMS. For that reason, the elements referring to the management representative were considered not met at the time of the gap analysis.

ISO 14001 Element No. 4.4.2:

Training, Awareness, and Competence

It was assumed that training required by laws and regulations is being accomplished; therefore, the requirements pertaining to such training are considered "Met." No additional costs for regulatory training requirements are applied to the ISO 14001costing.

ISO 14001 Element No. 4.4.4:

EMS Documentation

Although a manual is not specifically required by ISO 14001, it is expected that most Registrars will cite this element to require a published ISO 14001 manual. Because this element is a requirement unique to ISO 14001, none of the Centers or Component Facilities (except for White Sands Test Facility) was considered to have met this requirement.

ISO 14001 Element No. 4.4.5:

Document Control

It was assumed that the environmental documents that need to be controlled could be placed into the same document control system as is being used for ISO 9001. Therefore, this element was considered "Met" for all Centers and Component Facilities. Even though the ISO 9001 management system may not yet be in place, it is known that it will be and that the document control systems can be used for ISO 14001 documents. Therefore, there are no additional costs involved.

ISO 14001 Element No. 4.4.6

Operational Control

ISO 14001 requires that significant aspects be subjected to operational controls to ensure compliance with requirements. Since significant aspects have not been identified, this element cannot be fully addressed. However, as noted above under Objectives and Targets, it is assumed that the environmental managers have considerable understanding of their significant aspects. Therefore, the existence of operational controls was evaluated from that standpoint, and credit was given for having operational controls in place.

ISO 14001 Element No. 4.4.7

Emergency Preparedness Response

All NASA Centers and Component Facilities are required by law to have emergency preparedness response plans in place. Therefore, this element of ISO 14001 was considered met at all NASA Centers and Component Facilities.

ISO 14001 Element No. 4.5.2

Nonconformance, Corrective and Preventive Action

The procedures necessary to meet ISO 9001 can also be used to satisfy ISO 14001. Therefore, this element is considered "Met" for NASA at all Centers and Component Facilities.

ISO 14001, Element No. 4.5.3

Records

Not only is this a requirement of ISO 9001, but the federal government has well established records requirements that NASA is following. While some Centers and Component Facilities do not fully have their records organized and well managed, this element is considered "Met" because the requirements to do so are not unique to ISO 14001. These requirements should be met, and the costs of meeting the requirements are not a cost of implementing ISO 14001.

ISO 14001, Element No. 4.5.4

EMS Audit

EPA Protocol Audits include auditing the management system. Some work will be required for procedures to address the ISO 14001 elements. The mechanisms are in place, through the EPA Protocol Audits, however. Therefore, this element is considered over 80% met.

ISO 14001, Element No. 4.6

Management Review

EPA Protocol Audits include a management review function, which substantially addresses the ISO 14001 requirements.

3.3 Description of the Alternatives

This report provides four alternatives for ISO 14001 implementation. Table 3.3-1 summarizes the EMS under the implementation models.

3.3.1 Alternative 1: The Do Nothing Scenario

Under this alternative, an ISO 14001 EMS is not adopted.

The only changes to current practices will be with respect to those changes that are necessary to implement an EMS under the Code of Environmental Management Practices (CEMP). Generally, this means that there are additional and continuous reporting requirements.

Table 3.1.2-1 identifies documents that are in the current NASA EMS. These documents are generally stovepiped, meaning each is developed and implemented separately from the others. Overall, this approach creates a fractured and less efficient means for implementing the EMS.

3.3.2 Alternative 2: The Site-Specific Certification Model

Under this alternative, each site develops, implements, registers, and maintains its own ISO 14001 EMS. There is minimal to no corporate involvement with this model.

3.3.3 Alternative 3: The Ford Model

Under this alternative, Corporate develops the basic EMS and generic procedures for implementation. Each site then develops, implements, registers, and maintains its own ISO 14001 EMS, based on the generic EMS developed by Corporate.

3.3.4 Alternative 4: The IBM Model

Under this alternative, there is one EMS for the overall organization. Corporate, with input from the individual locations, is responsible for developing and registering the EMS. In addition, Corporate assists the locations with implementation and maintenance, such as through providing ISO 14001 training lesson plans for the locations. There is one ISO 14001 registration; however, each location is subject to Registrar audits. Once the Registrar agrees that the location is ready, then that location's name is added to the overall certification.

Table 3.3-1 Summary of the Three Models Implementing ISO 14001

The Site-Specific Certification Model (Alternative 2)	The Ford Model (Alternative 3)	The IBM Model (Alternative 4)
Each site develops its own EMS Manual.	Corporate develops a generic EMS Manual. Each site develops its own Manual to address site-specific elements of ISO 14001.	Corporate develops one organization-wide Manual applicable to all the sites.
Corporate develops the environmental policy.	Corporate develops the environmental policy.	Corporate develops the environmental policy.
Each site develops and maintains its own significant environmental aspects.	Corporate establishes the procedure for determining significant environmental aspects. Each site determines its own significant environmental aspects.	Corporate establishes significant aspects for the organization. Sites can establish additional significant aspects that are site-specific.
Each site establishes individual site-specific objectives and targets and the programs necessary to achieve them.	Corporate establishes generic objectives and targets that each site can use to establish individual site-specific objectives and targets and the programs necessary to achieve them.	Corporate establishes organization-wide objectives and targets and programs for achieving them. Each site establishes site-specific objectives and targets and the programs to achieve all objectives and targets.
Each site has its own ISO 14001 management representative.	Each site has its own ISO 14001 management representative.	There is one organization-wide ISO 14001 management representative at Corporate, who interfaces with coordinators at each site.
Each site develops and conducts its own ISO 14001 training.	Corporate develops standardized training lesson plans for ISO 14001. Each site conducts its own training.	Corporate develops standardized training lesson plans for ISO 14001. Corporate assists each site in conduct of its ISO 14001-related training and awareness campaigns.

Table 3.3-1 Summary of the Three Models Implementing ISO 14001

The Site-Specific Certification Model (Alternative 2)	The Ford Model (Alternative 3)	The IBM Model (Alternative 4)
ISO 9001 systems are used to implement several ISO 14001 elements, including Document Control; parts of Monitoring and Measurement; Nonconformance, Corrective and Preventive Action; and Records.	ISO 9001 systems are used to implement several ISO 14001 elements, including Document Control; parts of Monitoring and Measurement; Nonconformance, Corrective and Preventive Action; and Records.	ISO 9001 systems are used to implement several ISO 14001 elements, including Document Control; parts of Monitoring and Measurement; Nonconformance, Corrective and Preventive Action; and Records.
Procedures are developed at site for EMS audits and management reviews. Top management is the site's Director.	Corporate develops generic EMS audit and management review procedures. Each site implements the procedures. Top management is the site's Director.	Audits and management reviews are conducted on an organization-wide basis. Top management is at Corporate.

3.4 Analysis Approach

3.4.1 How Advantages and Disadvantages Were Determined

Advantages and Disadvantages of Implementing ISO 14001

In order to determine the advantages and disadvantages of implementing ISO 14001, data were reviewed from the benchmark companies. Details of each benchmark company's response are provided, under separate cover, in the Benchmarking Case Studies Report.

Criteria used in developing the advantages and disadvantages for the three ISO 14001 implementation models included whether or not:

- ➜ The benefits to be derived from the model are organization-wide or site-wide.
- ➜ The model offers an opportunity for paperwork reduction.
- ➜ The model is more efficient than the other models.
- ➜ The model is in accordance with the National Performance Review.
- ➜ The model is more cost-effective than the other models.
- ➜ The model offers consistency of implementation throughout the organization.

3.4.2 How Costs and Benefits Were Determined

Alternative 1: The "Do Nothing" Alternative

No cost-benefit data were gathered for Alternative 1 since the costs of no action are already being borne by NASA. The intent of this Business Case is to provide NASA with data regarding the additional costs involved in developing, implementing, registering, and maintaining an ISO 14001 EMS. Alternative 1 is a baseline from which additional costs for the three other alternatives are presented.

Alternatives 2-4: Models for ISO 14001 Implementation

Costs

During the gap analyses, it was found that NASA is either meeting, or close to meeting, a significant number of the requirements in ISO 14001. This was also the condition of the benchmark organizations when they made the decision to implement ISO 14001. As a result, we relied significantly on the findings of the benchmark organizations in determining costs.

In general, the benchmark companies each dedicated two people, for at least half their time, to development and initial implementation of the EMS. Although the benchmark companies did not hire additional personnel, a dedicated amount of time of this magnitude cannot be considered a

sunken cost. Therefore, this time is shown as a net cost, split between a NASA federal employee and the NASA contractor.

The other personnel involved in the project were employees who spent approximately 10% or less of their time working on the ISO 14001 EMS. These costs were considered sunken costs and are therefore not reflected in the net figures shown in this report.

Registration costs from the Registrars were varied among the benchmark companies. Some benchmark companies verbally provided information that could not be printed in the benchmark report because it was considered proprietary. However, based on the information provided, we estimate that most Centers and Component Facilities will spend about $75,000 for a three-year contract with the Registrar. Some of the smaller Centers and Component Facilities were estimated at $65,000.

Benefits

Advantages and disadvantages of implementing ISO 14001, as well as the differences between the models, are presented in Section 3.5.1. Section 3.5.2 addresses benefits that we were able to quantify. There are two areas where benefits were identified that some quantifiable measures could be applied:

Quantified Benefit No. 1

After implementing ISO 14001, all the benchmark companies stated that they were able to manage their activities better, especially during periods of declining or flat resources, even as their overall workload increased. This is significant because each benchmarked organization had good environmental practices when each started ISO 14001 development. Yet they were still able to increase the efficiency of their overall management of environmental affairs.

Because of this, the benchmark organizations were able to mitigate the need to hire additional people. In a few cases, the organizations were in an active downsizing mode. These organizations found that they were able to continue to effectively manage the EMS because of the ISO 14001 EMS.

Conservatively, a value of 1 FTE has been assigned as a quantitative measure of this benefit. That is, in most cases, the ISO 14001 EMS was considered to help avoid hiring an additional person. In the case of a downsizing organization, the minimum loss is 1 FTE. Translating this to salary and benefits results in a savings of approximately $100,000 per site.

Quantified Benefit No. 2

Several benchmarked organizations stated that they have received some oversight relief as a result of their having an ISO 14001 EMS. These included the following:

- In one case, a corporate audit was postponed for two years because of a specific division's ISO 14001 certification. The cost to that division of participating in and following up on previous corporate audits had been in the range of $100,000 to $150,000 per audit.

- ➜ A GAO audit of a DOE contractor was cancelled, partially due to the ISO 14001 certification.
- ➜ One site is in active negotiations with its State regulators, seeking to obtain regulatory relief from permitting durations, reporting intervals, and more permitting sign-off authority.
- ➜ One organization was exempted from some stringent customer-specific requirements due to having an ISO 14001 EMS. In addition, its customer has significantly reduced the number of oversight audits it performs. The overall value of this benefit was estimated to be as high as 15% of their environmental organization's budget.

Conservatively, the value of this benefit is estimated to be at least $100,000 per site.

It is known that NASA can realize this benefit at two of its Centers because of the willingness of the State of California to negotiate Memoranda of Understanding with respect to regulatory relief (ref. Appendix A). Therefore, NASA should be able to realize a minimum benefit of $200,000 by establishing Memoranda of Understanding between the California Environmental Protection Agency and Ames Research Center and Dryden Flight Research Center. This figure excludes the Jet Propulsion Laboratory (JPL) because JPL did not participate in the development of this Business Case.

3.4.3 How Resources to Maintain Were Determined

There are three considerations for maintenance of the ISO 14001 EMS. Each is discussed below:

NASA Federal Employee Utilization

All of the benchmarks found that no additional employees were needed to maintain the ISO 14001 EMS. The work could be performed as a normal part of each employee's job.

Therefore, it was determined that no additional federal employee requirements were necessary, except in the case of Headquarters for the IBM model. Because of the significant role that Headquarters has in the IBM model and the involvement with all of the Centers and Component Facilities, there is a need for Headquarters to dedicate approximately 0.5 FTE to that activity.

Registration Costs

As a general rule, NASA will need to sign a 3-year contract with a Registrar. During that 3-year period, the Registrar conducts an initial registration audit and then conducts surveillances of part of the EMS every 6 months to 1 year. At the end of the 3-year period, a recertification audit is performed and the process starts anew.

Annual costs for this process were estimated at 1/3 the full cost of registration.

Contractor Costs

During the maintenance of the EMS, NASA may request that its contractors perform a variety of functions. These could include assisting during the registration surveillances, following up on nonconformances, conducting training sessions, maintaining awareness programs, maintaining

updated legal requirements, assisting with performance of audits, etc. This is not intended to be an all-inclusive list.

For most Centers and Component Facilities, $50,000 was allotted for contractor assistance during maintenance of the EMS. Less was allotted to some of the smaller Centers and Component Facilities.

3.5 Analysis Results

3.5.1 Advantages and Disadvantages of ISO 14001

Advantages

- ➜ Achieved greater efficiencies and streamlined operations with no reduction in performance (AlliedSignal, Ford, IBM)
- ➜ Better focus on areas needing attention through identification of significant environmental aspects (IBM, Lockheed Martin, AlliedSignal)
- ➜ Heightened employee awareness of the EMS and ownership in improving environmental performance (AlliedSignal, DOE Savannah River, Ford, IBM)
- ➜ Significant reduction in oversight audits from outside organizations (AlliedSignal, DOE Savannah River, Lockheed Martin)
- ➜ Greater management and/or stakeholder visibility of the EMS (AlliedSignal, DOE Savannah River, IBM, Lockheed Martin)
- ➜ Greater focus on consistency and continual improvement in the EMS (DOE Savannah River, IBM, Lockheed Martin)
- ➜ Provide basis for better and more streamlined relationship with the regulators (DOE Savannah River, Ford, Lockheed Martin)
- ➜ EMS is now more structured and is system-dependent rather than personnel-dependent (IBM)
- ➜ Developing the ISO 14001 EMS is in line with corporate objectives of being a good corporate citizen (Ford)
- ➜ More recognition of the EMS by other corporate and international organizations (IBM)
- ➜ Better documentation of environmental issues (IBM)

Disadvantages

The following disadvantages of implementing ISO 14001 were stated as considerations by one of the benchmark organizations:

- ➜ ISO 14001 does not set environmental performance criteria; therefore, implementation of ISO 14001 will not necessarily, in and of itself, improve environmental performance.
- ➜ With the exception of receiving external recognition, there may be little advantage to aligning the environmental system with ISO 14001 if the organization already has a comprehensive EMS.

➜ Developing an ISO 14001 EMS requires creating paperwork that does not currently exist. It is necessary to ensure that the advantages outweigh the additional paperwork created by ISO 14001.

Once the decision is made to implement ISO 14001 on a corporate-wide basis, the next step is to determine which model offers the best advantages. Table 3.5.1-1 summarizes the advantages and disadvantages of each ISO 14001 implementation model.

Table 3.5.1-1 Advantages and Disadvantages of Each ISO 14001 Implementation Model

Measurement Criteria	Site-Specific Certification Model (Alt. 2)	Ford Model (Alt. 3)	IBM Model (Alt. 4)
Corporate-Wide vs. Site-Specific	Site-Specific	Both	Corporate-wide
Offers Opportunity for Paperwork Reduction and Meeting National Performance Review Requirements	Least Paperwork Reduction	More Paperwork Reduction	Most Paperwork Reduction
Efficiency and Streamlining of Operations	Least Streamlined	More Streamlined	Most Streamlined
Cost-Effectiveness	Least Cost-Effective	More Cost-Effective	Most Cost-Effective
Consistency of EMS Within the Organization	No Consistency Between Sites	Consistent EMS with Differences Between Sites	Total Consistency Throughout the Organization

3.5.2 Costs and Benefits

Development, Implementation, and Registration Costs

Table 3.5.2-1 shows the net costs for each Center and Component Facility to develop, implement, and register an ISO 14001 EMS for each of the three models presented in this Business Case.

Table 3.5.2-1 Additional Resources Required to Develop, Implement and Register to ISO 14001 by Center and Component Facility (except JPL)

Center or Component Facility	Site-Specific Certification Model (Alternative 2)	Ford Model (Alternative 3)	IBM Model (Alternative 4)
Ames Research Center	$310,000 + 0.5 NASA FTE	$275,000 + 0.5 NASA FTE	$200,000
Dryden Flight Research Center	$250,000 + 0.5 NASA FTE	$215,000 + 0.5 NASA FTE	$165,000
Goddard Space Flight Center	$385,000 + 0.5 NASA FTE	$360,000 + 0.5 NASA FTE	$285,000
NASA Headquarters	$225,000 + 0.5 NASA FTE	$425,000 + 0.5 NASA FTE	$800,000 + 1 NASA FTE
Johnson Space Flight Center	$385,000 + 0.5 NASA FTE	$360,000 + 0.5 NASA FTE	$285,000
Kennedy Space Center	$360,000 + 0.5 NASA FTE	$325,000 + 0.5 NASA FTE	$275,000
Langley Research Center	$285,000 + 0.5 NASA FTE	$270,000 + 0.5 NASA FTE	$195,000
Lewis Research Center	$310,000 + 0.5 NASA FTE	$275,000 + 0.5 NASA FTE	$200,000
Marshall Space Flight Center	$320,000 + 0.5 NASA FTE	$285,000 + 0.5 NASA FTE	$210,000
Michoud Assembly Facility	$225,000	$190,000	$165,000
Stennis Space Center	$250,000 + 0.5 NASA FTE	$215,000 + 0.5 NASA FTE	$190,000
Wallops Flight Facility	$275,000 + 0.5 NASA FTE	$240,000 + 0.5 NASA FTE	$215,000
White Sands Test Facility	$195,000	$180,000	$155,000
Total Costs =	$3,775,000 + 5.5 NASA FTE	$3,615,000 + 5.5 NASA FTE	$3,340,000 + 1 NASA FTE

Benefits

As described in Section 5.2, quantifiable benefits are equal to at least $1.5 million per year. Based on these benefits, NASA will receive a payback of its development, implementation, and registration costs in approximately 2-3 years, based on the model selected. Following the payback period, the benefits exceed the costs on an annual basis by $600,000 per year (see Section 6.3).

3.5.3 Resources to Maintain the EMS

Once the ISO 14001 EMS is in place, annual maintenance costs are estimated as follows:

~$75,000 per year

Ames Research Center
Goddard Space Flight Center
NASA Headquarters (+1.0 NASA FTE for the IBM Model only)
Johnson Space Center
Kennedy Space Center
Langley Research Center
Lewis Research Center
Marshall Space Flight Center

~$50,000 per year

Dryden Flight Research Center
Michoud Assembly Facility
Stennis Space Center
Wallops Flight Facility
White Sands Test Facility

A breakdown and explanation of the above costs is provided in Appendix B for each Center and Component Facility.

Section 5.3 explains how the costs were determined.

3.6 CONCLUSIONS AND RECOMMENDATIONS

3.6.1 Conclusions

Based on the data presented in Section 6.0 of this Business Case, it is MEGA-TECH and MACTEC's opinion that:

1. NASA should implement ISO 14001 on an Agency-wide basis, and

2. The best model for NASA's purposes is the IBM Model.

It is our opinion that the advantages of ISO 14001 outweigh the disadvantages. ISO 14001 allows NASA the opportunity to achieve consistency of operations throughout the Agency, promote systems and process integration, achieve efficiencies and streamline operations, establish a model for continual improvement, heighten employee awareness of the EMS and generate ownership for environmental performance, establish better relationships with the regulators, and develop worldwide recognition of the NASA EMS.

The costs of implementing ISO 14001 are not significant when measured against the benefits. Regardless of the model chosen, ISO 14001 will achieve payback in 2-3 years. After that, there is a net benefit over the costs of having an ISO 14001 EMS in place.

To do nothing will not be without its costs either. Because the current systems are stovepiped, NASA is not managing its environmental programs in the most efficient manner possible. This was also the case with several of the benchmark companies before they implemented ISO 14001. They all had a good EMS in place, but most agree that the ISO 14001 EMS improved their efficiencies. Additional costs involved in NASA remaining in its current status have to do with the need to meet the Code of Environmental Management Practices (CEMP). This requires the continuing burden of reporting to the EPA on each Center and Component Facility's compliance. For these reasons, we conclude that NASA should choose to begin implementing ISO 14001 on an Agency-wide basis.

Once the decision is made to implement ISO 14001, then NASA needs to choose the model that it will follow.

While most of the benchmarks chose the Site-Specific Certification Model, it should also be noted that those benchmarks, which did choose this model, were in very decentralized organizations. In each case, there was no involvement or assistance from Headquarters. At NASA, there has been , and continues to be, a strong corporate focus at Headquarters. The NASA Headquarters environmental management structure can significantly contribute to reducing costs, duplication of effort, and paper. Therefore, it is our opinion that the Site-Specific Certification Model is not the best model for NASA to follow.

The Ford Model involves a Headquarters structure, and that structure is used to develop a standardized EMS throughout the organization. However, each Ford site still develops and certifies its own

EMS. This is a good model for a situation like Ford's because Ford has a large number of sites located around the world. It is not practical for Ford Headquarters to be able to become individually involved with each site.

The current scope of IBM's certificate is similar to NASA in size. It includes 12 IBM locations in addition to Corporate Environmental Affairs. This model will reduce paperwork and duplication of effort across the Agency. As a result, this model comes closest to satisfying the goals of the National Performance Review, as well as the Government Performance and Results Act. The cost of implementing the IBM model is less than the cost of implementing the other models. For these reasons, we believe that NASA should choose to implement the IBM model.

3.6.2 Recommendations

It is recommended that NASA begin implementation of an ISO 14001 EMS by developing an EMS at Headquarters that will be adopted by all of the Centers and Component Facilities. This system should be based on the best practices that each Center and Component Facility has to offer.

IBM started with two pilot locations. They found this conservative approach to be very beneficial. The lessons learned were then applied to the EMS for the other locations.

The two NASA Centers and Component Facilities that we recommend for pilot studies are Langley Research Center and White Sands Test Facility. Both are closest to currently implementing ISO 14001. White Sands Test Facility is closest because it wants to become ISO 14001 certified, and it has been working at attaining certification. Langley Research Center, on the other hand, has not been specifically working toward ISO 14001, but its management has developed and implemented most of the good practices that are contained in the ISO 14001 standard. We believe that both facilities can be models for NASA once the pilot projects are completed. Upon successful completion of the pilot projects, we recommend that NASA develop lessons learned and make a decision regarding further implementation of ISO 14001.

3.7 REFERENCES

In addition to the gap analyses and benchmark studies, literature searches were conducted as part of the ongoing business case development project. The following documents and internet sites were reviewed, in part or in whole, and appropriate data was taken from the documents for use in this Business Case:

1. Benchmarking Case Studies Report, MEGA-TECH and MACTEC, September 1998

2. The Environmental Management Report, Volume 2, Numbers 6-12, McGraw-Hill, 1997

3. The Environmental Management Report, Volume 3, Numbers 1-7, McGraw-Hill, 1998

4. Global Environmental Management: Candid Views of Fortune 500 Companies, U.S. – Asia Environmental Partnership, October 1997

5. Goodman, Sally. ISO 14001 — Business Survival? A Presentation at the 3rd Annual Environmental Management Systems & ISO 14001 Conference, February 1998

6. International Environmental Systems Update, Volume 4, Numbers 9-12, CEEM Information Services, 1997

7. International Environmental Systems Update, Volume 5, Numbers 1-6, CEEM Information Services, 1998

8. ISO 14000@quality.org, 1997-1998

9. The National ISO 14001 and Environmental Standards Integration Conference Proceedings, Energy and Environmental Division in cooperation with ASQ and RAB, March 2-4, 1998

10. Proceedings of the 23rd Annual Conference of the National Association of Environmental Professionals, June 20-24, 1998

11. http://www.ISO 14000.org/

APPENDIX A

TRENDS TOWARD ISO 14001

Purpose

The purpose of this Appendix is to provide additional information regarding ISO 14001 implementation by organizations other than NASA and the benchmark organizations. This appendix shows increasingly positive interest toward ISO 14001.

Introduction

There have been several interesting developments related to ISO 14001 since the start of this Business Case development. Some of the new initiatives and actions related to ISO 14001 include the following:

- EPA Published a Position Statement on ISO 14001;
- IBM Encouraged All 1,000 of Its Suppliers to Become ISO 14001 Registered;
- The Number of ISO 14001 Registrations Increased by Over 1,000% in the United States;
- The Department of Energy and Several States and Local Governments Began Moving Toward ISO 14001 Registration; and
- Several Fortune 500 Companies Began Considering and Registering to ISO 14001.

Each of these is discussed in more detail below.

EPA Position Paper

On March 12, 1998, the U.S. EPA published, in *The Federal Register*, its position on EMSs and ISO 14001. Issuance of this position has, for the first time, made ISO 14001 a public policy issue.

In the EPA's position paper, they state: *EPA encourages the use of EMSs that focus on improved environmental performance and compliance with regulatory requirements. EPA supports and will help promote the development and use of EMSs,* ***including those based on the ISO 14001 standard****, that help an organization achieve its environmental obligations and broader environmental performance goals.*

The statement continues by stating that EPA plans to work closely with all key stakeholders in order to determine the effectiveness of ISO 14001 EMSs in reducing pollution and preventing pollution. EPA is especially involved in a partnership with the States in doing this.

There are six categories which EPA is currently collecting data on the effectiveness of ISO 14001 EMSs. These categories are: Environmental Performance, Compliance, Pollution Prevention, Environmental Conditions, Costs/Benefits, and Stakeholder Participation and Confidence.

While the overall statement encourages the use of EMSs, such as ISO 14001, it does also state that at this time, EPA is not basing any regulatory incentives solely on the use of EMSs, or on certification to ISO 14001. However, the general tone of the statement is positive towards ISO 14001 and is encouraging for organization's considering development and implementation of an ISO 14001 EMS.

IBM Suppliers

Another significant move that has occurred recently in support of ISO 14001 in the United States was the issuance of a letter by IBM on April 20, 1998 encouraging all IBM suppliers to become ISO 14001 registered. This will have the effect of increasing ISO 14001 certifications in the United States by another 1,000 organizations.

In the letter to each supplier, IBM states: *"IBM encourages you to align your EMS with the requirements of ISO 14001 and to pursue registration under this international standard. This message comes in light of the increasing worldwide interest in environmental affairs and as part of IBM's overall ISO 14001 strategy. We are interested in doing business with environmentally responsible suppliers and also believe that such registration can be of benefit to you."*

1,000% Increase in U.S. ISO 14001 Registrants

As of July 1997, there were 17 ISO 14001 registered organizations in the United States, according to McGraw-Hill's *Environmental Management Report.* By July 1998, the number of U.S. registered companies had increased to 172.

While the numbers are still small, it appears that they will grow rapidly. For example, as indicated above, IBM alone has requested that its 1,000 suppliers become ISO 14001 registered. It is anticipated, based on the current growth rate and the addition of the IBM suppliers to the pool of registrants, that there could be close to 3,000 registered organizations in the United States by the end of calendar year 1999.

Department of Energy Actions Toward ISO 14001

DOE, as a Federal Agency, has received ISO 14001 certification at two of its sites: Savannah River and the Waste Isolation Pilot Project (WIPP) in Carlsbad, New Mexico. In addition, several DOE contractors are obtaining, or self-declaring, at DOE sites. These include AlliedSignal at Kansas City, MO and WASTREN at Grand Junction, CO.

DOE Savannah River and AlliedSignal in Kansas City, MO were among the benchmarks performed for this Business Case. In addition, WASTREN in Grand Junction was visited during the course of this Business Case. Input from all site visits to DOE facilities was considered in the development of this Business Case.

States' Actions toward ISO 14001

Fifteen (15) States are investigating ISO 14001 and collecting data on how an ISO 14001 EMS can affect environmental performance, pollution prevention activities, and the costs and benefits of an ISO 14001 EMS. The U.S. EPA is funding some of this work.

The following States are currently investigating ISO 14001: Arizona, California, Illinois, Indiana, Iowa, Massachusetts, Minnesota, Missouri, New Hampshire, North Carolina, Oregon, Pennsylvania, Texas, Vermont, and Wisconsin.

Of particular interest to NASA are the States of California and Texas.

California: Cal/EPA has stated that it is seeking ways to streamline permitting, auditing and inspecting, monitoring, and reporting processes. Accordingly, Cal/EPA will work with organizations achieving ISO 14001 certification to develop a project plan and establish a Memorandum of Understanding (MOU) between the organization and Cal/EPA.

Texas: At the current time, Texas does not offer regulatory relief or flexibility with respect to organizations establishing ISO 14001 EMSs. However, Texas is initiating a pilot project to study ISO 14001 implementation. Texas appears to be interested in the positive impacts that an ISO 14001 EMS can provide.

Local Government Actions Toward ISO 14001

In addition to the States, there are eight local governmental organizations that are developing ISO 14001 EMSs at specific government run facilities. These eight local governments include Gaithersburg, MD (public works); Indianapolis, Indiana (public works); Lansing Board of Water and Light, Michigan (electric generating facility); Londonderry, New Hampshire (public works); Lowell, Massachusetts (wastewater treatment facility); New York City, New York (waste management); Scottsdale, Arizona (municipal government); and Wayne County, Michigan (wastewater treatment facility).

Fortune 500 Actions Toward ISO 14001

Fortune 500 organizations are moving to become ISO 14001 conforming. Most Fortune 500 companies believe that, while they currently have good EMSs, meeting international standards like ISO 14001 will become mandatory for future business relationships.

Therefore, while many Fortune 500 companies are holding back from attaining ISO 14001 certification, most are at least ensuring that they are conforming to ISO 14001.

Some have taken a proactive approach and become certified. Some are starting to expect that their suppliers also become certified. Following is a partial listing of some of the Fortune 500 companies and actions they have taken toward ISO 14001.

Apple Computer: Has two ISO 14001-certified sites; the rest of the company is becoming "ISO 14001 Ready."

ARCO Chemical Company: ARCO chairs the Environmental Performance Evaluation SubTAG to TC 207, responsible for development of ISO 14001 standards. ARCO's current *Manufacturing Excellence* program incorporates ISO 14001 elements and exceeds ISO 14001 requirements.

Bristol Myers Squibb: BMS' goal is to become the first large global company to become ISO 14001 certified. To date, sites in England, Connecticut, Mexico, and the Netherlands have become certified. BMS believes that ISO 14001 will offer it a distinct market advantage.

Canon: Twenty five (25) of Canon's sites are ISO 14001 certified. Currently, only two of the sites are in the United States. All of Canon's Japanese sites will be ISO 14001 certified by the end of 1998.

Eastman Kodak: Kodak management has requested that all Kodak facilities be ready for ISO 14001 by the end of calendar year 1998.

Ford Motor Company: Ford has established corporate procedures around ISO 14001. Individual sites are attaining ISO 14001 certification, in conjunction with the use of Ford's corporate procedures.

General Motors: GM is developing its global EMS template with ISO 14001 conformance as an integral element for its business units. Some GM business units have already received ISO 14001 certification.

IBM: IBM has received a Worldwide Certification of its development and manufacturing facilities. Corporate Headquarters and twelve IBM locations are currently included in that worldwide certification. IBM is requesting that all of its 1,000 suppliers consider obtaining ISO 14001 certification.

Lockheed Martin: Lockheed Martin has an ISO-like corporate policy and has hired two consultants to help make Lockheed Martin ISO-compatible. Eleven of Lockheed Martin's U.S. sites have individual ISO 14001 certifications.

Lucent Technologies: There are eight ISO 14001-registered sites in the United States for Lucent Technologies.

Monsanto: Monsanto is currently piloting an ISO 14001 project at one of its plants in Texas.

Motorola: Motorola has two ISO 14001 certified sites and is preparing for certification at its other 78 sites.

NEC: NEC has a customized EMS that incorporates ISO 14001. All Japanese sites will be certified by the end of 1998.

Rockwell International: Rockwell International has seven (7) locations certified to ISO 14001 and is also working on becoming certified as a company.

Shell Oil Company: Shell is setting up environmental partnerships with 16 of its key suppliers. Those partners will become certified to either EMAS or ISO 14001 (Note: EMAS is a European EMS with much more stringent requirements than are in ISO 14001).

Siemens: Siemens is specifying either ISO 14001 or EMAS to its suppliers.

Xerox: There are five (5) Xerox facilities certified to ISO 14001 in the United States.

APPENDIX B

GAP ANALYSIS REPORTS

This appendix provides the results of the gap analyses that were performed at each Center and Component Facility. Each report identifies how close the specific NASA Center or Component Facility is to addressing each line item of ISO 14001.

This includes the actual checklists that were used during the gap analyses. The checklist is based on each line item of the standard. Each line item stands on its own and is not to be compared with the other line items.

Completion of each checklist item involved a qualitative judgment as to how close the Center or Component Facility was to implementing the requirement. The results of these gap analysis checklist items were used to assist the reviewers in determining what it will take for NASA to become ISO 14001 certified.

At the end of each checklist is a summary of actions needed to address ISO 14001. This is not considered a detailed list of all specific actions required. It was compiled for use in estimating costs necessary to implement ISO 14001.

Each report includes a breakdown of costs for development, implementation, registration, and maintenance of the ISO 14001 EMS.

Ames Research Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
1/22/98

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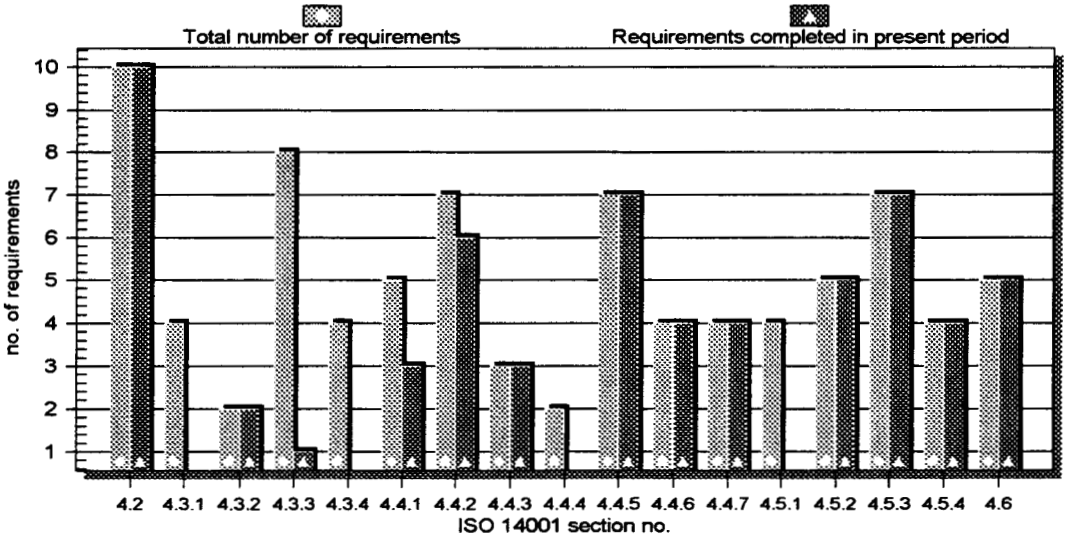
The purpose of this report is to summarize the status of Ames Research Center's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Ames Research Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Ames Research Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Ames Research Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net cost for Ames Research Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Ames Research Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Ames Research Center. It also forms the basis for setting Ames Research Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Ames Research Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization		X	
• consider the organization's legal and other requirements when establishing and reviewing its objectives		X	
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives		X	
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives		X	
• consider the views of interested parties when establishing and reviewing its objectives	X		
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution		X	

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Ames Research Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets			X
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization			X
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved			X
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services			X

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Ames Research Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	>80% met	20-80% met	<20% met
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Ames Research Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs	X		
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Ames Research Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization	X		
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision	X		

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Ames Research Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Ames Research Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Ames Research Center's environmental policy, objectives and targets are met. In this regard, Ames Research Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors	X		

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Ames Research Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures		X	
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Ames Research Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Ames Research Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Ames Research Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Ames Research Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

III. Recommended Actions

This section identifies and prioritizes major recommended actions for Ames Research Center's to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects *Checklist reference:* 4.3.11 1. Establish procedures for environmental aspects and identify aspects.
4.3.3 Objectives and targets *Checklist reference:* 4.3.31 1. Extract objectives and targets from existing documents (ERI, AHB, etc.). 2. Tie objectives and targets to significant environmental impacts, environmental policy, etc.
4.3.4 Environmental management program *Checklist reference:* 4.3.41 1. Once objectives and targets have been established, establish how those objectives and targets will be met.
4.4.1 Structure and responsibility *Checklist reference:* 4.4.11 1. Identify Management Representative.
4.4.2 Training, awareness and competence *Checklist reference:* 4.4.21 1. Provide Awareness Training of ISO 14001 Program and Policy.
4.4.4 EMS documentation *Checklist reference:* 4.4.41 1. Need an EMS manual to tie the program together.
4.4.5 Document Control Checklist reference: 4.4.5.1 1. Identify environmental documents to control 2. Roll into ISO 9000 document control 3. Include process for review and approval of all documents.

Recommended Actions to Meet ISO 14001 Requirements

4.5.1 Monitoring and measurement
Checklist reference: **4.5.11**
1. Tie measuring of performance to objectives and targets as they relate to significant impacts.

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Ames Research Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $75,000 [2]	0.5 FTE [1] $40,000 [2]	No Net FTE Costs $40,000 [2]
Implementing the EMS	0.5 FTE [1] $150,000 [2]	0.5 FTE [1] $150,000 [2]	No Net FTE Costs $75,000 [2]
Registering the EMS	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]
Total Costs through Registration =	**$310,000 + 0.5 FTE**	**$275,000 + 0.5 FTE**	**$200,000 No Net FTE Costs**
Annual Maintenance Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Dryden Flight Research Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
1/24/98

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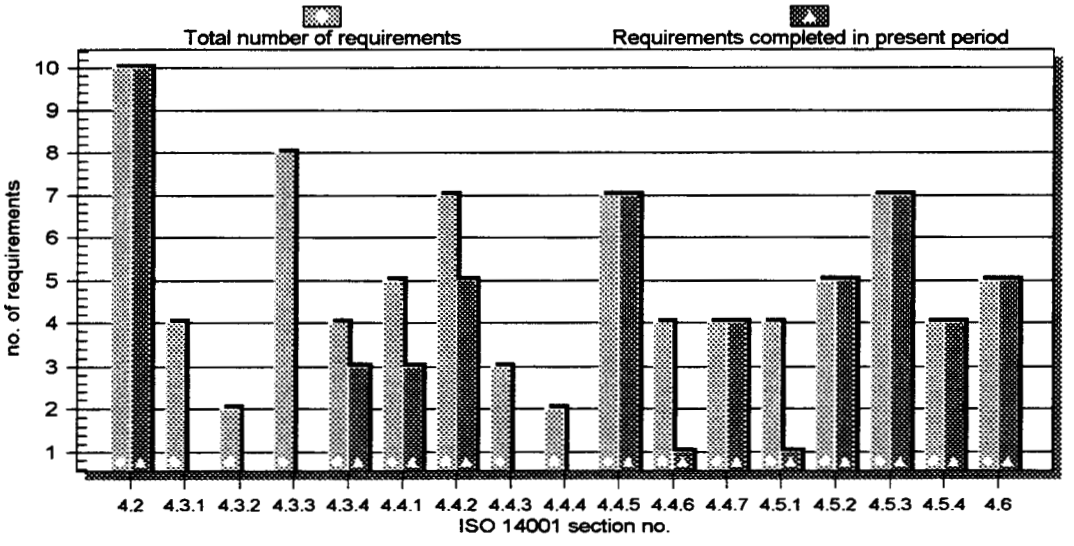
The purpose of this report is to summarize the status of Dryden Flight Research Center's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Dryden Flight Research Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Dryden Flight Research Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Dryden Flight Research Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net costs for Dryden Flight Research Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Dryden Flight Research Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the of Dryden Flight Research Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Dryden Flight Research Center. It also forms the basis for setting Dryden Flight Research Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's organizational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Dryden Flight Research Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization			X
• consider the organization's legal and other requirements when establishing and reviewing its objectives			X
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives			X
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives			X
• consider the views of interested parties when establishing and reviewing its objectives			X
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution			X

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Dryden Flight Research Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets		X	
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization	X		
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved	X		
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services	X		

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Dryden Flight Research Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Dryden Flight Research Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs			X
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance			X
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Dryden Flight Research Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization		X	
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties		X	
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Dryden Flight Research Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Dryden Flight Research Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Dryden Flight Research Center's environmental policy, objectives and targets are met. In this regard, Dryden Flight Research Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets			X
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors	X		

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Dryden Flight Research Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Dryden Flight Research Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Dryden Flight Research Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Dryden Flight Research Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Dryden Flight Research Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Dryden Flight Research Center's to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects *Checklist reference:* **4.3.11** 1. Establish procedures for environmental aspects and identify aspects.
4.3.2 Legal and other requirements *Checklist reference:* **4.3.21** 1. Formalize how legal and other requirements are maintained up-to-date.
4.3.3 Objectives and targets *Checklist reference:* **4.3.31** 1. Develop objectives and targets.
4.3.4 Environmental management program *Checklist reference:* **4.3.41** 1. Develop procedure that describes program for established objectives and targets.
4.4.2 Training, awareness and competence *Checklist reference:* **4.4.21** 1. Identify environmental training needs for each position on-site. 2. Provide training to all employees on the environmental policy.
4.4.3 Communication *Checklist reference:* **4.4.31** 1. Formalize procedures for internal and external communications. 2. Record the decision on documenting environmental aspects to external entities.
4.4.4 EMS documentation *Checklist reference:* **4.4.41** 1. Need an EMS manual to tie the program together.

Recommended Actions to Meet ISO 14001 Requirements

4.4.5 Document Control *Checklist reference:* **4.4.5.1** 1. Identify environmental documents to control 2. Roll into ISO 9000 document control 3. Include process for review and approval of all documents.
4.4.6 Operational control *Checklist reference:* **4.4.61** 1. Once the policy objectives and targets are identified, develop procedures for activities that may lead to deviations from the policy, objectives and targets.
4.5.1 Monitoring and measurement *Checklist reference:* **4.5.11** 1. Formalize internal process for measuring and monitoring. 2. Continue to use site calibration program. 3. Tie program to objectives and targets.
4.5.4 Environmental management system audit *Checklist reference*: **4.5.41** 1. Modify EPA protocol audits to address ISO 14001. 2. Conduct EMS audit.

Dryden Flight Research Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.25 FTE [1] $75,000 [2]	0.25 FTE [1] $40,000 [2]	No Net FTE Costs $40,000 [2]
Implementing the EMS	0.25 FTE [1] $100,000 [2]	0.25 FTE [1] $100,000 [2]	No Net FTE Costs $50,000 [2]
Registering the EMS	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]
Total Costs through Registration =	**$250,000 + 0.5 FTE**	**$215,000 + 0.5 FTE**	**$165,000 No Net FTE Costs**
Annual Maintenance Costs	$21,667 [3] $30,000 [2] No Net FTE Costs	$21,667 [3] $30,000 [2] No Net FTE Costs	$21,667 [3] $30,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Goddard Space Flight Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
11/3/97

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I. Summary

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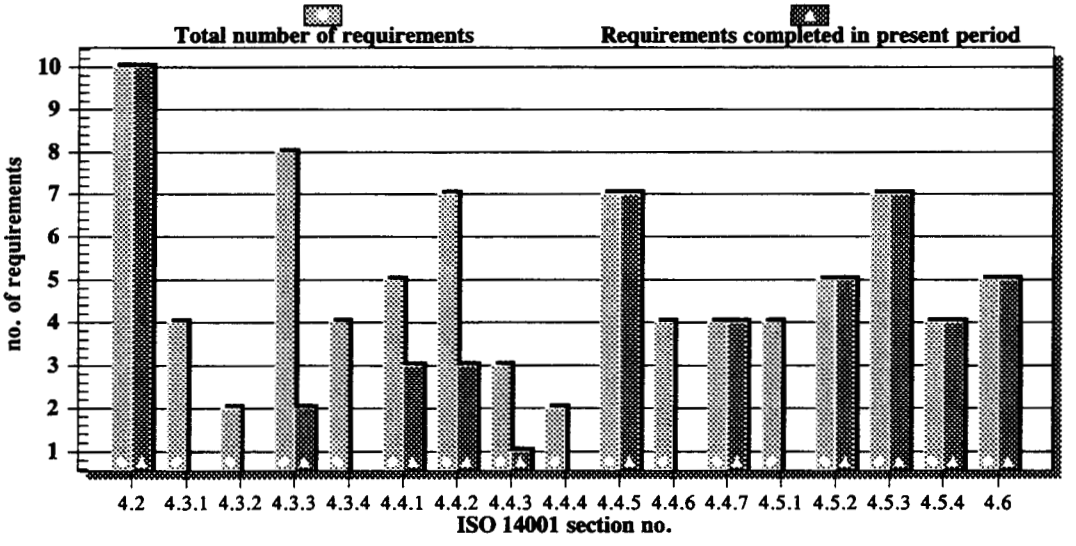
The review of Goddard Space Flight Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Goddard Space Flight Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Goddard Space Flight Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net costs for Goddard Space Flight Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Goddard Space Flight Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Goddard Space Flight Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Goddard Space Flight Center It also forms the basis for setting Goddard Space Flight Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public			

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then defines the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Goddard Space Flight Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization		X	
• consider the organization's legal and other requirements when establishing and reviewing its objectives	X		
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives	X		
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives			X
• consider the views of interested parties when establishing and reviewing its objectives		X	
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution		X	

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Goddard Space Flight Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets		X	
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization		X	
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved		X	
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services		X	

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Goddard Space Flight Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Goddard Space Flight Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs		X	
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Goddard Space Flight Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization	X		
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties		X	
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Goddard Space Flight Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Goddard Space Flight Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Goddard Space Flight Center's environmental policy, objectives and targets are met. In this regard, Goddard Space Flight Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors		X	

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
•establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
•establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
•review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
•periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Goddard Space Flight Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
•establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
•ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures		X	
•establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Goddard Space Flight Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Goddard Space Flight Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Goddard Space Flight Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Goddard Space Flight Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions to meet the requirements for Goddard Space Flight Center to meet the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Review existing objectives and targets against significant aspects and against legal and other requirements.
2. Establish new objectives and targets as necessary.
3. Assign priorities to objectives and targets.
4. Obtain Center Director's approval.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Establish programs to meet the objective and targets.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**

1 Assign an individual to be responsible for ISO 14000 program.
2 Define the roles and responsibilities of that individual covered by revision of GM 1173.1
3. Conduct assessment of environmental organizations responsibilities to ensure sufficient availability of resources.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Establish procedures for center-wide training of personnel for environmental awareness.
   A) Develop lesson plans, presentation materials and handouts.
   B) Conduct training.
   C) Finish training plan.
   D) Develop lesson plans.
   E) Conduct training.

Recommended Actions to Meet ISO 14001 Requirements

4.4.3 Communication
Checklist reference: **4.4.31**
1. Establish formalized procedures for communication, particularly to handle external communications.

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

4.4.5 Document Control
Checklist reference: **4.4.5.1**
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.4.6 Operational control
Checklist reference: **4.4.61**
1. Review procedures and contracts against significant aspects, policy, objectives and targets, legal rights, etc.
2. Revise or write procedures as necessary
3. Train personnel on new or revised procedures (estimate under training).

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Goddard Space Flight Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $100,000 [2]	0.5 FTE [1] $75,000 [2]	No Net FTE Costs $50,000 [2]
Implementing the EMS	0.5 FTE [1] $200,000 [2]	0.5 FTE [1] $200,000 [2]	No Net FTE Costs $150,000 [2]
Registering the EMS	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]
Total Costs through Registration =	**$385,000 + 0.5 FTE**	**$360,000 + 0.5 FTE**	**$285,000 No Net FTE Costs**
Annual Maintenance Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

NASA Headquarters

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
7/15/98

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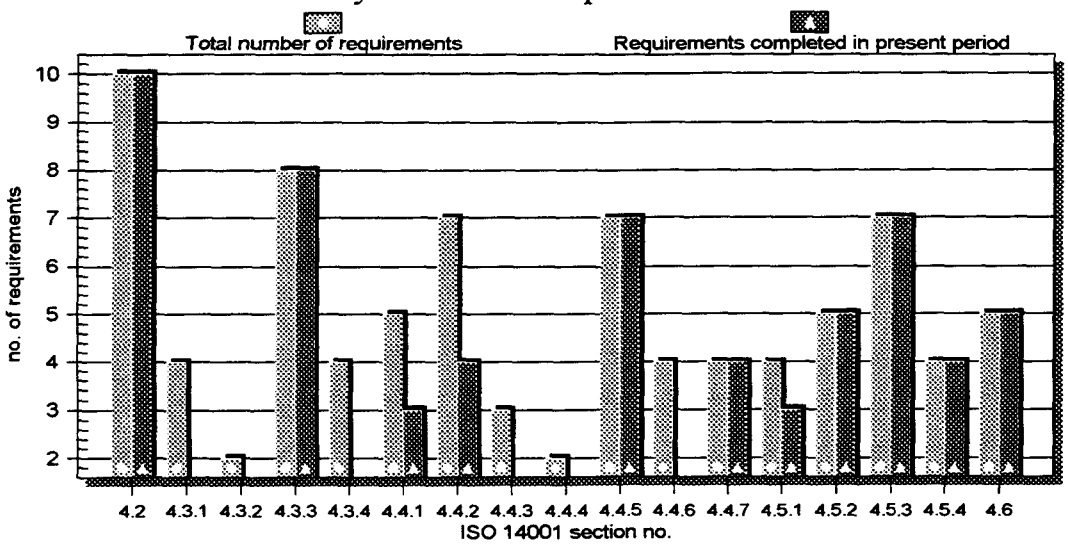
The purpose of this report is to summarize the status of NASA Headquarters's environmental management system with respect to meeting the requirements of ISO 14001.

The review of NASA Headquarters environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of NASA Headquarters assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that NASA Headquarters will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net costs for NASA Headquarters to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by NASA Headquarters against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the NASA Headquarters environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for NASA Headquarters. It also forms the basis for setting NASA Headquarters's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

NASA Headquarters must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization	X		
• maintain documented environmental objectives and targets at each relevant function and level within the organization	X		
• consider the organization's legal and other requirements when establishing and reviewing its objectives	X		
• consider the organization's significant environmental aspects when establishing and reviewing its objectives	X		
• consider the organization's technological options when establishing and reviewing its objectives	X		
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives	X		
• consider the views of interested parties when establishing and reviewing its objectives	X		
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution	X		

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

NASA Headquarters's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets		X	
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization		X	
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved		X	
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services		X	

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

NASA Headquarters must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

NASA Headquarters must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs	X		
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

NASA Headquarters must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization		X	
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties		X	
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

NASA Headquarters's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and NASA Headquarters's documentation control procedures therefore should be effective and efficient.

Document control requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

This element does not apply to Headquarters except that Headquarters needs to address it in the EMS manual.

Operational control requirements	>80% met	20-80% met	<20% met
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets	Not able to assess		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets	Not able to assess		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria	Not able to assess		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors	Not able to assess		

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

NASA Headquarters must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment	X		
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets	X		
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	Not able to assess		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations	X		

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

NASA Headquarters must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

NASA Headquarters must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

NASA Headquarters must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

NASA Headquarters's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for NASA Headquarters to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.2 Environmental policy
Checklist reference: **4.2.10**
1. The current policy should be reviewed to ISO 14001 and revised to reflect ISO 14001, including for continual improvement.

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.2 Legal and other requirements
Checklist reference: **4.3.21**
1. Establish formal procedures for review of legal and other requirements and for transmitting results for the review to the Centers and component facilities.
2. Procedures also need to provide basic description for how Centers and component facilities review legal and other requirements.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Headquarters needs to document a process for determining objectives and targets.
2. Headquarters - established objectives and targets need to be in conformance with the process established.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Ensure that implementation programs address ISO 14000 objectives and targets.
2. Headquarters procedures to define requirements for the Centers and component facilities.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**
1. Appoint a specific management representative.
2. Establish reporting mechanisms for management review of the EMS.
3. Headquarters procedures to define requirements for the Centers and component facilities.

Recommended Actions to Meet ISO 14001 Requirements

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Establish procedures for ISO14000 training.
2. Develop generic training lesson plans for ISO 14000 training at each Center and component facility.
3. Headquarters procedures to define requirements for the Centers and component facilities.

4.4.3 Communication
Checklist reference: **4.4.31**
1. Establish procedures for internal and external communication.
2. Consider public involvement in aspects and document decision.
3. Headquarters procedures to define requirements for the Centers and component facilities.

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

4.4.5 Document Control
Checklist reference: **4.4.5.1**
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.5.1 Monitoring and measurement
Checklist reference: **4.5.11**
1. Headquarters procedures to define requirements for the centers.
2. Headquarters should develop a master plan that sets forth key measurements for significant aspects, objectives and targets, cost expenditures on environmental projects, resources used, permit exceedances, etc.

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

NASA Headquarters

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	$75,000 [2] +0.5 FTE [1]	$275,000 [2] +0.5 FTE [1]	$300,000 [2] + 1.0 FTE [1]
Implementing the EMS	$75,000 [2] +0.5 FTE [1]	$75,000 [2] +0.5 FTE [1]	$300,000 [2] + 1.0 FTE [1]
Registering the EMS	$65,000 [3] $10,000 [2] +0.5 FTE	$65,000 [3] $10,000 [2] +0.5 FTE [1]	$100,000 [3] $100,000 [2] + 1.0 FTE [1]
Total Costs through Registration =	**$275,000 +0.5 FTE**	**$425,000 +0.5 FTE**	**$800,000 + 1.0 FTE**
Maintaining the EMS	$50,000 [2] $21,667 [3]	$50,000 [2] $21,667 [3]	$50,000 [2] $30,000 [3] + 1.0 FTE [1]

ASSUMPTIONS AND EXPLANATIONS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Johnson Space Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
3/19/98

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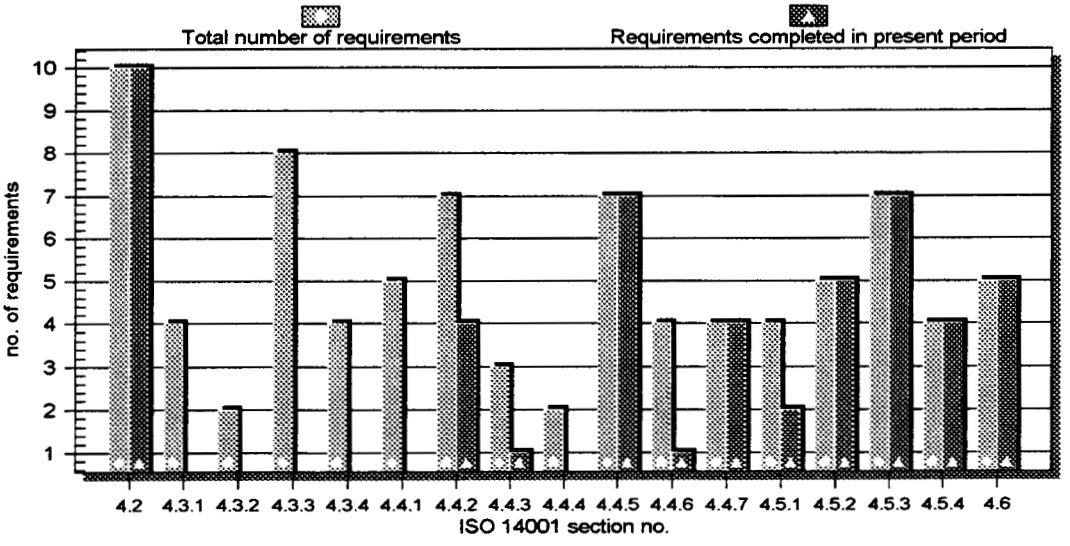
The purpose of this report is to summarize the status of Johnson Space Center's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Johnson Space Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Johnson Space Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Johnson Space Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net cost for Johnson Space Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Johnson Space Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Johnson Space Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Johnson Space Center. It also forms the basis for setting Johnson Space Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Johnson Space Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization			X
• consider the organization's legal and other requirements when establishing and reviewing its objectives		X	
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives		X	
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives		X	
• consider the views of interested parties when establishing and reviewing its objectives			X
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution			X

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Johnson Space Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets			X
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization			X
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved			X
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services			X

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Johnson Space Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management		X	
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management		X	
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources		X	
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Johnson Space Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs		X	
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Johnson Space Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization		X	
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Johnson Space Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Johnson Space Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Johnson Space Center's environmental policy, objectives and targets are met. In this regard, Johnson Space Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors	X		

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Johnson Space Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets	X		
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Johnson Space Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Johnson Space Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Johnson Space Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Johnson Space Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Johnson Space Center to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.2 Legal and other requirements
Checklist reference: **4.3.21**
1. Need to establish procedures in this area.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Need to establish documented objectives and targets.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Once environmental objectives and targets are established, then establish environmental management programs.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**
1. Need to document and define the cross-site organizational structure for ISO 14000 management, including designation of the ISO 14000 management representative and reporting relationships.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Establish and document training needs for ISO 14001 awareness training and for training of personnel whose jobs significantly affect the environment.
2. Establish procedures for training for ISO 140001.
3. Develop training programs for ISO 14001.
4. Conduct training.

Recommended Actions to Meet ISO 14001 Requirements

4.4.3 Communication
Checklist reference: **4.4.31**
1. Establish and implement procedures for internal communication.
2. Consider and document whether to publicly relate aspects.

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

4.4.5 Document Control
Checklist reference: **4.4.5.1**
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.4.6 Operational control
Checklist reference: **4.4.61**
1. Once environmental aspects are identified, review existing procedures to ensure all operations associated with significant environmental aspects are included.

5.1 Monitoring and measurement
Checklist reference: **4.5.11**
1. Once environmental aspects are identified, review existing procedures to ensure all operations associated with significant environmental aspects are included.

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Johnson Space Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $100,000 [2]	0.5 FTE [1] $75,000 [2]	No Net FTE Costs $50,000 [2]
Implementing the EMS	0.5 FTE [1] $200,000 [2]	0.5 FTE [1] $200,000 [2]	No Net FTE Costs $150,000 [2]
Registering the EMS	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]
Total Costs through Registration =	**$385,000 + 0.5 FTE**	**$360,000 + 0.5 FTE**	**$285,000 No Net FTE Costs**
Annual Maintenance Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Kennedy Space Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
11/20/97

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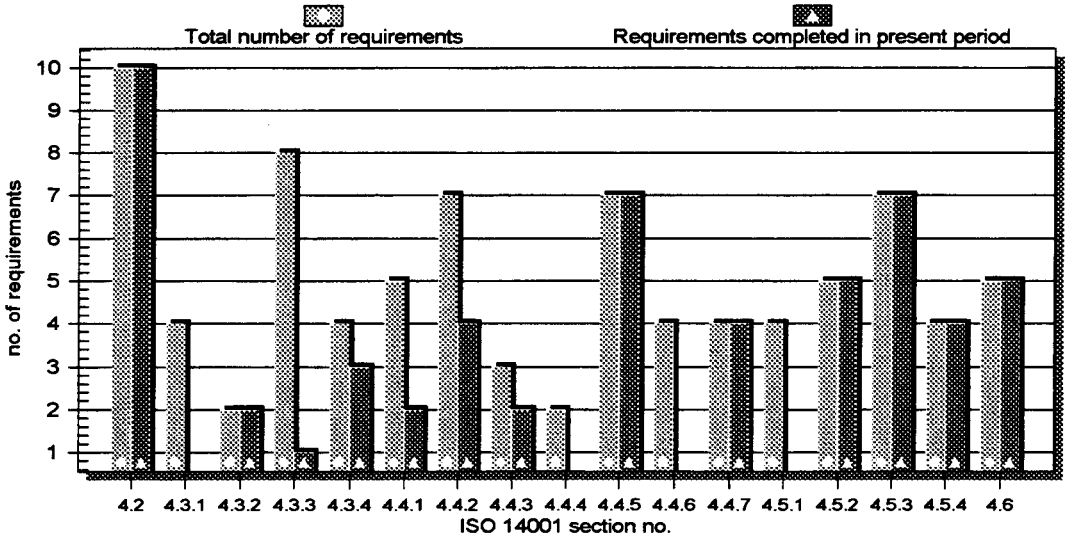
The review of Kennedy Space Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Kennedy Space Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Kennedy Space Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net costs for Kennedy Space Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Kennedy Space Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Kennedy Space Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Kennedy Space Center. It also forms the basis for setting Kennedy Space Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy	**>80% met**	**20-80% met**	**<20% met**
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then defines the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Kennedy Space Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization		X	
• consider the organization's legal and other requirements when establishing and reviewing its objectives		X	
• consider the organization's significant environmental aspects when establishing and reviewing its objectives		X	
• consider the organization's technological options when establishing and reviewing its objectives		X	
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives		X	
• consider the views of interested parties when establishing and reviewing its objectives		X	
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution	X		

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Kennedy Space Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets	X		
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization	X		
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved	X		
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services		X	

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Kennedy Space Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources		X	
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Kennedy Space Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs		X	
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system			X
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance			X
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Kennedy Space Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization	X		
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Kennedy Space Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Kennedy Space Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Kennedy Space Center's environmental policy, objectives and targets are met. In this regard, Kennedy Space Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors		X	

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Kennedy Space Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures		X	
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Kennedy Space Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Kennedy Space Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Kennedy Space Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Kennedy Space Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Kennedy Space Center to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Establish objectives and targets for improvement of significant aspects after identifying:
   A) legal and other requirements
   B) technical options
   C) financial, operation, and business requirements
   D) views of interested parties
   E) environmental policy
2. Reconsider the structures of the environmental objective documents to place BMP's, instructions, and work practices in other documents leaving objectives and targets in those documents.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Currently have good system but will need to evaluate against above objectives and targets once established.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**
1. KSC states additional people needed to establish ISO 14001 program.
2. KSC states additional people needed to maintain EMS in current state.
3. Appoint a specific ISO 14001 management representative.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Formalize training needs assessment.
2. Develop ISO 14001 awareness training and provide to all employees Center-wide.
3. Develop training relevant to significant aspects and impacts; provide to appropriate personnel, including all environmental coordinators.

Recommended Actions to Meet ISO 14001 Requirements

4.4.3 Communication
Checklist reference: **4.4.31**
1. Once significant environmental aspects have been determined, need to consider processes for external communication of significant aspects and record the decision made.

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

4.4.5 Document Control
Checklist reference: **4.4.5.1**
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.4.6 Operational control
Checklist reference: **4.4.61**
1. Once policy, observations and targets are established, associated operations and activities need to be identified and the procedures for those activities be documented (including preventing deviations).

4.5.1 Monitoring and measurement
Checklist reference: **4.5.11**
1. Key characteristics need to tie to significant aspects. Develop documented procedures as required.

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Kennedy Space Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $75,000 [2]	0.5 FTE [1] $40,000 [2]	No Net FTE Costs $40,000 [2]
Implementing the EMS	0.5 FTE [1] $200,000 [2]	0.5 FTE [1] $200,000 [2]	No Net FTE Costs $150,000 [2]
Registering the EMS	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]
Total Costs through Registration =	**$360,000 + 0.5 FTE**	**$325,000 + 0.5 FTE**	**$275,000 No Net FTE Costs**
Annual Maintenance Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Langley Research Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
2/9/98

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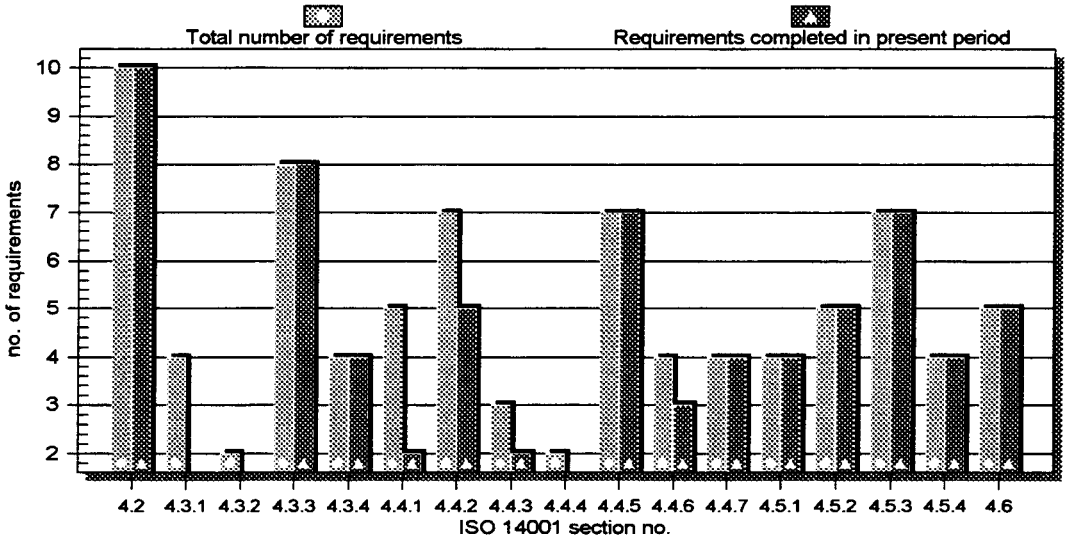
The purpose of this report is to summarize the status of Langley Research Center's environmental management system with respect to meeting the requirements of ISO 14001.

The review Langley Research Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Langley Research Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Langley Research Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net costs for Langley Research Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Langley Research Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Langley Research Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Langley Research Center. It also forms the basis for setting Langley Research Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Langley Research Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization	X		
• maintain documented environmental objectives and targets at each relevant function and level within the organization	X		
• consider the organization's legal and other requirements when establishing and reviewing its objectives	X		
• consider the organization's significant environmental aspects when establishing and reviewing its objectives	X		
• consider the organization's technological options when establishing and reviewing its objectives	X		
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives	X		
• consider the views of interested parties when establishing and reviewing its objectives	X		
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution	X		

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Langley Research Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets	X		
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization	X		
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved	X		
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services	X		

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Langley Research Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources		X	
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Langley Research Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs	X		
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Langley Research Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization	X		
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Langley Research Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
•establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Langley Research Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Langley Research Center's environmental policy, objectives and targets are met. In this regard, Langley Research Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors		X	

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
•establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
•establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
•review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
•periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Langley Research Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
•establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment	X		
•ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets	X		
•ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
•establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations	X		

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Langley Research Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Langley Research Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Langley Research Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Langley Research Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Langley Research Center to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects *Checklist reference:* **4.3.11** 1. Establish procedures for environmental aspects and identify aspects.
4.3.2 Legal and other requirements *Checklist reference*: **4.3.21** 1. Need to document procedures this area.
4.3.4 Environmental management program *Checklist reference:* **4.3.41** 1. The P2 program establishes project descriptions which address this element of ISO 14001. Need to ensure program descriptions are developed for each identified objective and target.
4.4.1 Structure and responsibility *Checklist reference:* **4.4.11** 1. Issue letter from Center Director assigning the ISO 14000 Management Representative and establishing reporting requirements for reporting to top management.
4.4.2 Training, awareness and competence *Checklist reference:* **4.4.21** 1. Once the EMS is in place, training must be provided to ensure all employes are aware of the environmental policy and how it affects their activities.
4.4.3 Communication *Checklist reference:* **4.4.31** 1. Document decision for external communications of aspects.
4.4.4 EMS documentation *Checklist reference:* **4.4.41** 1. Need an EMS manual to tie the program together.

Recommended Actions to Meet ISO 14001 Requirements

4.4.5 Document Control
Checklist reference: 4.4.5.1
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

4.4.6 Operational control
Checklist reference: 4.4.61
1. Evaluate to ensure adequate documented procedures exist to control significant aspects.
2. Ensure adequate controls are passed on to subcontractors.

4.5.1 Monitoring and measurement
Checklist reference: 4.5.11
1. Excellent program for compliance monitoring; however, procedures are not written. Recommend developing written procedures to address this area.

4.5.2 Non-conformance, corrective and preventive action
Checklist reference: 4.5.21
1. Excellent controls are in place for handling nonconformances, corrective and preventive actions. However, procedures are not written. Recommend developing written procedures to address this area.

4.5.3 Records
Checklist reference: 4.5.31
1. Utilize Langley directive for records.
2. Evaluate directives for compatibility with ISO 14001.

4.5.4 Environmental management system audit
Checklist reference: 4.5.41
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Langley Research Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $50,000 [2]	0.5 FTE [1] $35,000 [2]	No Net FTE Costs $35,000 [2]
Implementing the EMS	0.5 FTE [1] $150,000 [2]	0.5 FTE [1] $150,000 [2]	No Net FTE Costs $75,000 [2]
Registering the EMS	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]
Total Costs through Registration =	**$285,000 + 0.5 FTE**	**$270,000 + 0.5 FTE**	**$195,000 No Net FTE Costs**
Annual Maintenance Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Lewis Research Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
2/9/98

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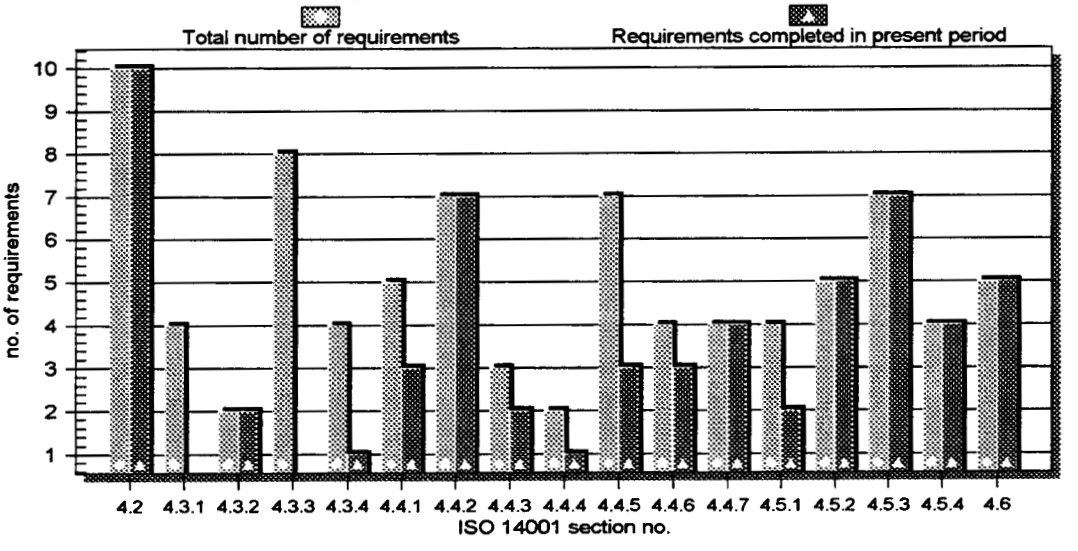
The purpose of this report is to summarize the status of Lewis Research Center's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Lewis Research Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Lewis Research Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Lewis Research Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net costs for Lewis Research Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Lewis Research Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the of Lewis Research Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Lewis Research Center. It also forms the basis for setting Lewis Research Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Lewis Research Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization		X	
• consider the organization's legal and other requirements when establishing and reviewing its objectives		X	
• consider the organization's significant environmental aspects when establishing and reviewing its objectives		X	
• consider the organization's technological options when establishing and reviewing its objectives		X	
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives		X	
• consider the views of interested parties when establishing and reviewing its objectives		X	
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution		X	

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Lewis Research Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets		X	
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization	X		
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved		X	
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services		X	

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Lewis Research Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	>80% met	20-80% met	<20% met
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Lewis Research Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs	X		
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Lewis Research Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization	X		
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Lewis Research Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction		X	
• establish and maintain information, in paper or electronic form, to provide direction to related information	X		

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Lewis Research Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located		X	
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use		X	
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified		X	
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document		X	

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Lewis Research Center's environmental policy, objectives and targets are met. In this regard, Lewis Research Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors	X		

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Lewis Research Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations	X		

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Lewis Research Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Lewis Research Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Lewis Research Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Lewis Research Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Lewis Research Center to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects *Checklist reference:* **4.3.11** 1. Establish procedures for environmental aspects and identify aspects.
4.3.3 Objectives and targets *Checklist reference:* **4.3.31** 1. Determine objectives and targets and tie to environmental policy.
4.3.4 Environmental management program *Checklist reference:* **4.3.41** 1. Based on objectives and targets, identify responsibilities, means and time frames.
4.4.5 Document Control *Checklist reference:* **4.4.5.1** 1. Identify environmental documents to control 2. Roll into ISO 9000 document control 3. Include process for review and approval of all documents.
4.4.6 Operational control *Checklist reference:* **4.4.61** 1. Area gap is based on the condition that environmental impacts have not been established in a manner consistent with ISO 14001. Areas may have to be adjusted if ISO 14001 is adopted and impacts require adjustment to current objective, targets and/or goals.
4.5.1 Monitoring and measurement *Checklist reference:* **4.5.11** 1. Procedure should be developed to include information to track performance, relevant operations controls and conformations to objectives and goals.
4.5.3 Records *Checklist reference:* **4.5.31** 1. LEPM Chapter 36 should be revised to include record control to match activities and actions currently implemented under the EMO Document Management System.

Lewis Research Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $75,000 [2]	0.5 FTE [1] $40,000 [2]	No Net FTE Costs $40,000 [2]
Implementing the EMS	0.5 FTE [1] $150,000 [2]	0.5 FTE [1] $150,000 [2]	No Net FTE Costs $75,000 [2]
Registering the EMS	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]
Total Costs through Registration =	**$310,000** **+ 0.5 FTE**	**$275,000** **+ 0.5 FTE**	**$200,000** **No Net FTE Costs**
Annual Maintenance Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Marshall Space Flight Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
1/8/98

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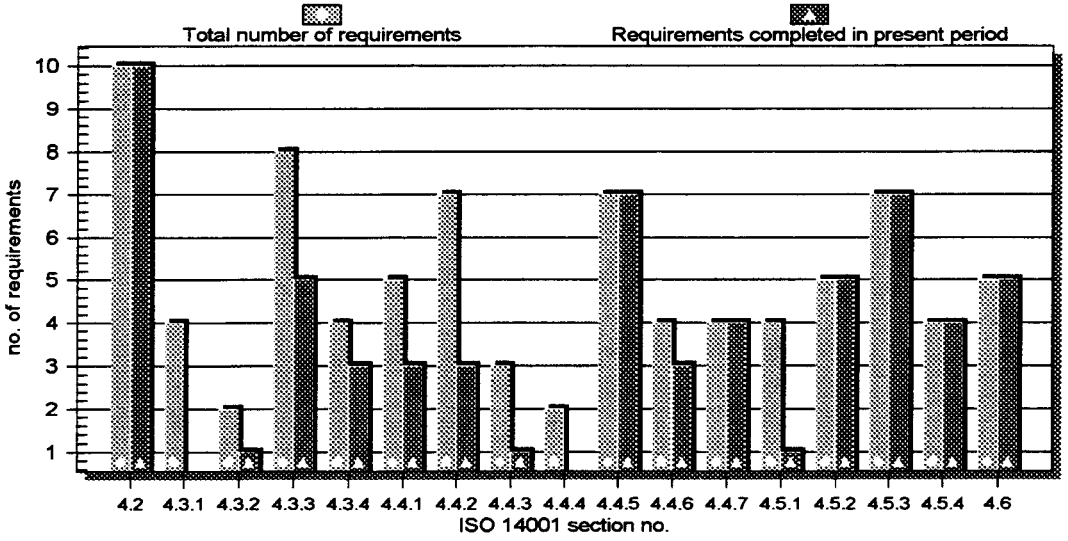
The purpose of this report is to summarize the status of Marshall Space Flight Center's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Marshall Flight Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Marshall Flight Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001.Section III, "Recommended Actions," identifies the actions that Marshall Space Flight Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net costs for Marshall Flight Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Marshall Space Flight Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Marshall Space Flight Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Marshall Space Flight Center. It also forms the basis for setting Marshall Space Flight Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Marshall Space Flight Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization	X		
• maintain documented environmental objectives and targets at each relevant function and level within the organization		X	
• consider the organization's legal and other requirements when establishing and reviewing its objectives		X	
• consider the organization's significant environmental aspects when establishing and reviewing its objectives	X		
• consider the organization's technological options when establishing and reviewing its objectives	X		
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives	X		
• consider the views of interested parties when establishing and reviewing its objectives		X	
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution	X		

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Marshall Space Flight Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets		X	
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization	X		
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved	X		
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services	X		

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Marshall Space Flight Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Marshall Space Flight Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs			X
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system			X
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance			X
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Marshall Space Flight Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization			X
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties		X	
• consider processes for external communication on the organization's significant environmental aspects and record its decision	X		

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Marshall Space Flight Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction		X	
• establish and maintain information, in paper or electronic form, to provide direction to related information		X	

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Marshall Space Flight Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Marshall Space Flight Center's environmental policy, objectives and targets are met. In this regard, Marshall Space Flight Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors		X	

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Marshall Space Flight Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Marshall Space Flight Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Marshall Space Flight Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Marshall Space Flight Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Marshall Space Flight Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Marshall Space Flight Center to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Identify aspects and impact.
2. Translate goals to objectives and targets.
3. Establish priorities.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. After objectives and targets are established, an overall EM program will have to be developed.
2. Program needs to assign responsibility, resources and time-frame.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Need to develop training needs assessment.
2. Establish procedures for training.
3. Provide site-wide EMS awareness training.
4. Provide training related to objectives and targets.

4.4.3 Communication
Checklist reference: **4.4.31**
1. Establish overall procedure for internal and external communications (could be similar to community relations plan already in existence.

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

Recommended Actions to Meet ISO 14001 Requirements

4.4.5 Document Control *Checklist reference:* **4.4.5.1** 1. Identify environmental documents to control 2. Roll into ISO 9000 document control 3. Include process for review and approval of all documents.
4.4.6 Operational control *Checklist reference:* **4.4.61** 1. Once objectives and targets are established, operations and activities can be identified. 2. The ERD and various plans can be used as a baseline for this element.
4.5.1 Monitoring and measurement *Checklist reference:* **4.5.11** 1. Once objectives and targets are established, measures of key characteristics can be established.
4.5.4 Environmental management system audit *Checklist reference*: **4.5.41** 1. Modify EPA protocol audits to address ISO 14001. 2. Conduct EMS audit.

Marshall Space Flight Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $85,000 [2]	0.5 FTE [1] $50,000 [2]	No Net FTE Costs $50,000 [2]
Implementing the EMS	0.5 FTE [1] $150,000 [2]	0.5 FTE [1] $150,000 [2]	No Net FTE Costs $75,000 [2]
Registering the EMS	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]	$75,000 [3] $10,000 [2]
Total Costs through Registration =	**$320,000 + 0.5 FTE**	**$285,000 + 0.5 FTE**	**$210,000 No Net FTE Costs**
Annual Maintenance Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs	$25,000 [3] $50,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Michoud Assembly Facility

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
12/8/97

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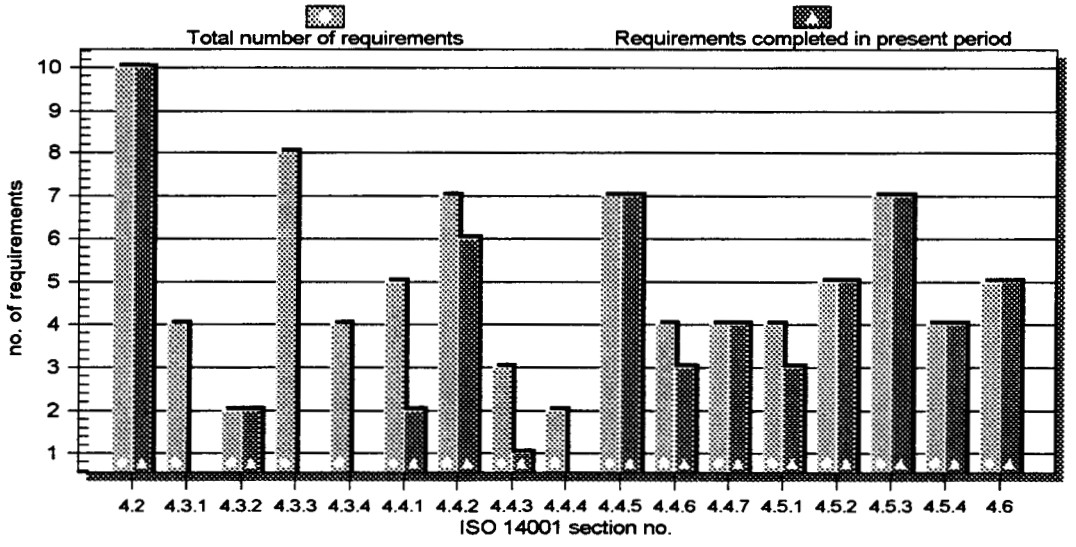
The purpose of this report is to summarize the status of Michoud Assembly Facility's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Michoud Assembly Facility's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Michoud Assembly Facility's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001.Section III, "Recommended Actions," identifies the actions that Michoud Assembly Facility will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net cost for Michoud Assembly Facility to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Michoud Assembly Facility against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Michoud Assembly Facility environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Michoud Assembly Facility. It also forms the basis for setting Michoud Assembly Facility's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	**>80% met**	**20-80% met**	**<20% met**
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Michoud Assembly Facility must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	**>80% met**	**20-80% met**	**<20% met**
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization			X
• maintain documented environmental objectives and targets at each relevant function and level within the organization			X
• consider the organization's legal and other requirements when establishing and reviewing its objectives			X
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives			X
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives			X
• consider the views of interested parties when establishing and reviewing its objectives			X
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution			X

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Michoud Assembly Facility's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets			X
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization			X
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved			X
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services			X

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Michoud Assembly Facility must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	>80% met	20-80% met	<20% met
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources			X
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Michoud Assembly Facility must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs	X		
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Michoud Assembly Facility must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization		X	
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision	Not able to assess		

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Michoud Assembly Facility's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Michoud Assembly Facility's documentation control procedures therefore should be effective and efficient.

Document control requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Michoud Assembly Facility's environmental policy, objectives and targets are met. In this regard, Michoud Assembly Facility must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria	X		
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors	X		

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Michoud Assembly Facility must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets	X		
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations	X		

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Michoud Assembly Facility must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Michoud Assembly Facility must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Michoud Assembly Facility must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Michoud Assembly Facility's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Michoud Assembly Facility to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Set documented objectives and targets based on significant aspects and impacts, as well as legal requirements, technological objects, business requirements, and views of interested parties.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Establish methodology for meeting established objectives and targets.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**
1. Identify specific ISO 14000 environmental structures and responsibilities.
2. Appoint an ISO 14000 management representative.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Once ISO 14000 is in place, conduct EMS awareness training for all employees (1 hour class).

4.4.3 Communication
Checklist reference: **4.4.31**
1. Formalize communications procedures
2. Consider and document decision on external communications of the environmental aspects.

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

Recommended Actions to Meet ISO 14001 Requirements

4.4.5 Document Control
Checklist reference: **4.4.5.1**
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Michoud Assembly Facility

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	[1] $75,000 [2]	[1] $40,000 [2]	[1] $40,000 [2]
Implementing the EMS	[1] $75,000 [2]	[1] $75,000 [2]	$50,000 [2]
Registering the EMS	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]
Total Costs through Registration =	**$225,000** **No Net FTE Costs**	**$190,000** **No Net FTE Costs**	**$165,000** **No Net FTE Costs**
Annual Maintenance Costs	$21,667 [3] $25,000 [2] No Net FTE Costs	$21,667 [3] $25,000 [2] No Net FTE Costs	$21,667 [3] $25,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Because Michoud is a GOCO facility, there are no net FTE costs to NASA.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Stennis Space Center

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
12/10/97

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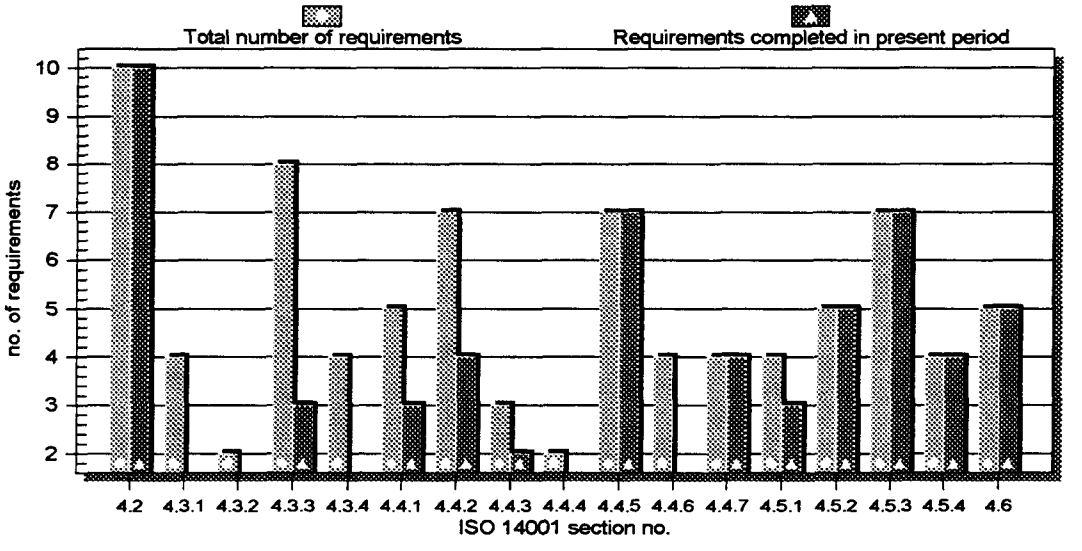
The purpose of this report is to summarize the status of Stennis Space Center's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Stennis Space Center's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Stennis Space Center's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001.Section III, "Recommended Actions," identifies the actions that Stennis Space Center will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net cost for Stennis Space Center to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Stennis Space Center against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Stennis Space Center environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Stennis Space Center. It also forms the basis for setting Stennis Space Center's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Stennis Space Center must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services			X
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services			X

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization		X	
• consider the organization's legal and other requirements when establishing and reviewing its objectives	X		
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives		X	
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives	X		
• consider the views of interested parties when establishing and reviewing its objectives	X		
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution		X	

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Stennis Space Center's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets		X	
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization			X
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved			X
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services			X

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Stennis Space Center must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management	X		
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Stennis Space Center must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs			X
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system			X
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance		X	
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Stennis Space Center must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization	X		
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision	Not able to assess		

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Stennis Space Center's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
• establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Stennis Space Center's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Stennis Space Center's environmental policy, objectives and targets are met. In this regard, Stennis Space Center must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets			X
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors		X	

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Stennis Space Center must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets	X		
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations	X		

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Stennis Space Center must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Stennis Space Center must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Stennis Space Center must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Stennis Space Center's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Stennis Space Center to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.2 Legal and other requirements
Checklist reference: **4.3.21**
1. Develop procedures for identifying and maintaining identification and access to legal and other requirements.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Set documented objectives and targets based on significant aspects and impacts, as well as legal requirements, technical options, business requirements, and views of interested parties.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Establish methodology for meeting established objectives and targets.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**
1. Appoint ISO 14000 Management Representative
2. Develop formalized reporting mechanisms between ISO 14000 Representative and Top Management.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Develop training plans (Need Assessments)
2. Conduct EMS training for all site employees

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

Recommended Actions to Meet ISO 14001 Requirements

4.4.5 Document Control
Checklist reference: **4.4.5.1**
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.4.6 Operational control
Checklist reference: **4.4.61**
1. Once significant aspects and impacts are developed, review operational procedures to ensure documented procedures exist where appropriate.

4.5.1 Monitoring and measurement
Checklist reference: **4.5.11**
1. Once significant aspects and impacts are developed, review monitoring and measurement procedures to ensure documented procedures exist where appropriate.

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Stennis Space Center

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $75,000 [2]	0.5 FTE [1] $40,000 [2]	No Net FTE Costs $40,000 [2]
Implementing the EMS	0.5 FTE [1] $100,000 [2]	0.5 FTE [1] $100,000 [2]	No Net FTE Costs $75,000 [2]
Registering the EMS	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]
Total Costs through Registration =	**$250,000** **+ 0.5 FTE**	**$215,000** **+ 0.5 FTE**	**$190,000** **No Net FTE Costs**
Annual Maintenance Costs	$21,667 [3] $30,000 [2] No Net FTE Costs	$21,667 [3] $30,000 [2] No Net FTE Costs	$21,667 [3] $30,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

Wallops Flight Facility

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
2/11/98

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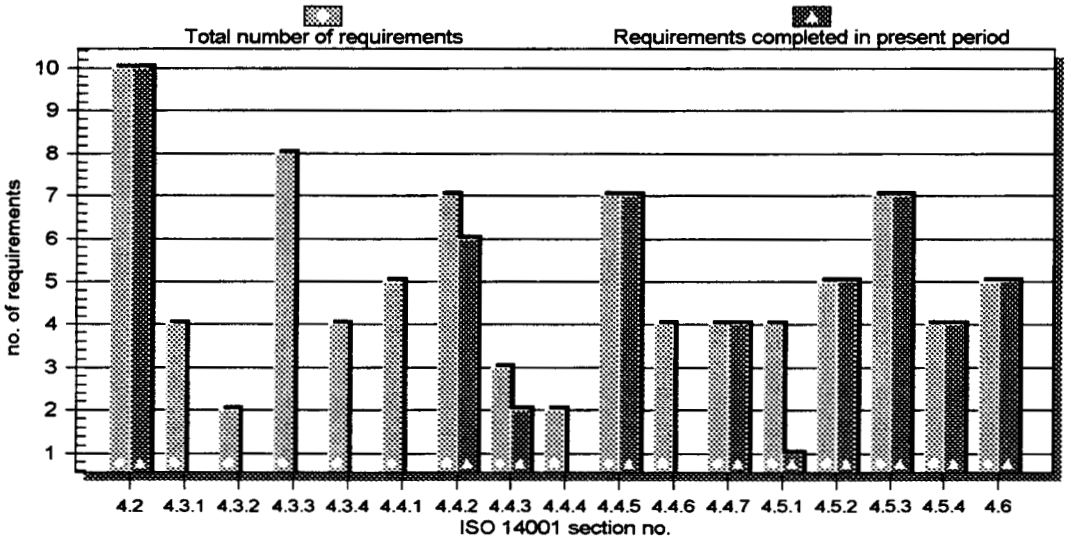
The purpose of this report is to summarize the status of Wallops Flight Facility's environmental management system with respect to meeting the requirements of ISO 14001.

The review of Wallops Flight Facility's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of Wallops Flight Facility's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that Wallops Flight Facility will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net cost for Wallops Flight Facility's to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by Wallops Flight Facility against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the Wallops Flight Facility environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for Wallops Flight Facility. It also forms the basis for setting Wallops Flight Facility's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	**>80% met**	**20-80% met**	**<20% met**
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

Wallops Flight Facility must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	**>80% met**	**20-80% met**	**<20% met**
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services			X
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services			X

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization		X	
• maintain documented environmental objectives and targets at each relevant function and level within the organization		X	
• consider the organization's legal and other requirements when establishing and reviewing its objectives		X	
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives			X
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives			X
• consider the views of interested parties when establishing and reviewing its objectives		X	
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution			X

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

Wallops Flight Facility's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets		X	
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization		X	
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved		X	
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services		X	

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

Wallops Flight Facility must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	>80% met	20-80% met	<20% met
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management		X	
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management		X	
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources		X	
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

Wallops Flight Facility must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs		X	
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

Wallops Flight Facility must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization	X		
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties	X		
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

Wallops Flight Facility's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
•establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction			X
•establish and maintain information, in paper or electronic form, to provide direction to related information			X

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and Wallops Flight Facility's documentation control procedures therefore should be effective and efficient.

Document control requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that Wallops Flight Facility's environmental policy, objectives and targets are met. In this regard, Wallops Flight Facility must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets			X
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors		X	

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential foi and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

Wallops Flight Facility must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

Wallops Flight Facility must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

Wallops Flight Facility must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

Wallops Flight Facility must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review

Checklist reference: **4.6.10**

Wallops Flight Facility's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for Wallops Flight Facility to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.2 Legal and other requirements
Checklist reference: **4.3.21**
1. Need to establish a procedure for review of laws and regulations. Include identification of responsibilities.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Review existing objectives and targets against significant aspects and against legal and other requirements.
2. Establish new objectives and targets as necessary.
3. Assign priorities to objectives and targets.
4. Obtain Center's Director's approval.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Need to develop implementation plan and strategies to achieve objectives and targets.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**
1. Assign an individual to be responsible for ISO 14000 program.
2. Define the roles and responsibilities of that individual. Cover by revision of documentation.
3. Conduct assessment of environmental organizations' responsibilities to ensure sufficient availability of resources.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Complete and issue the draft training plan to identify training needs.
2. Evaluate training needs for environmental staff and conduct training.
3. Provide ISO 14000 EMS awareness training to every employee.

Recommended Actions to Meet ISO 14001 Requirements

4.4.3 Communication
Checklist reference: **4.4.31**
1. Document the decision to externally communicate significant aspects.

4.4.4 EMS documentation
Checklist reference: **4.4.41**
1. Need an EMS manual to tie the program together.

4.4.5 Document Control
Checklist reference: **4.4.5.1**
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.4.6 Operational control
Checklist reference: **4.4.61**
1. Review procedures and contracts against significant aspects, policy, objectives and targets, legal rights etc.
2. Revise or write procedures as necessary.
3. Train personnel on revised procedure (evaluate under training).

4.5.1 Monitoring and measurement
Checklist reference: **4.5.11**
1. Need to establish documented procedures to monitor and measure operational activates, include verification of compliance activities.

4.5.4 Environmental management system audit
Checklist reference: **4.5.41**
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

Wallops Flight Facility

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	0.5 FTE [1] $75,000 [2]	0.5 FTE [1] $40,000 [2]	No Net FTE Costs $40,000 [2]
Implementing the EMS	0.5 FTE [1] $125,000 [2]	0.5 FTE [1] $125,000 [2]	No Net FTE Costs $100,000 [2]
Registering the EMS	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]	$65,000 [3] $10,000 [2]
Total Costs through Registration =	**$275,000 + 0.5 FTE**	**$240,000 + 0.5 FTE**	**$215,000 No Net FTE Costs**
Annual Maintenance Costs	$21,667 [3] $30,000 [2] No Net FTE Costs	$21,667 [3] $30,000 [2] No Net FTE Costs	$21,667 [3] $30,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Estimated net costs to NASA for additional federal employee responsibilities.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.

White Sands Test Facility

Environmental Management System
ISO 14001 Assessment Report

Prepared for: NASA
Prepared by: MEGA-TECH, Inc.
MACTEC, Inc.
1/20/98

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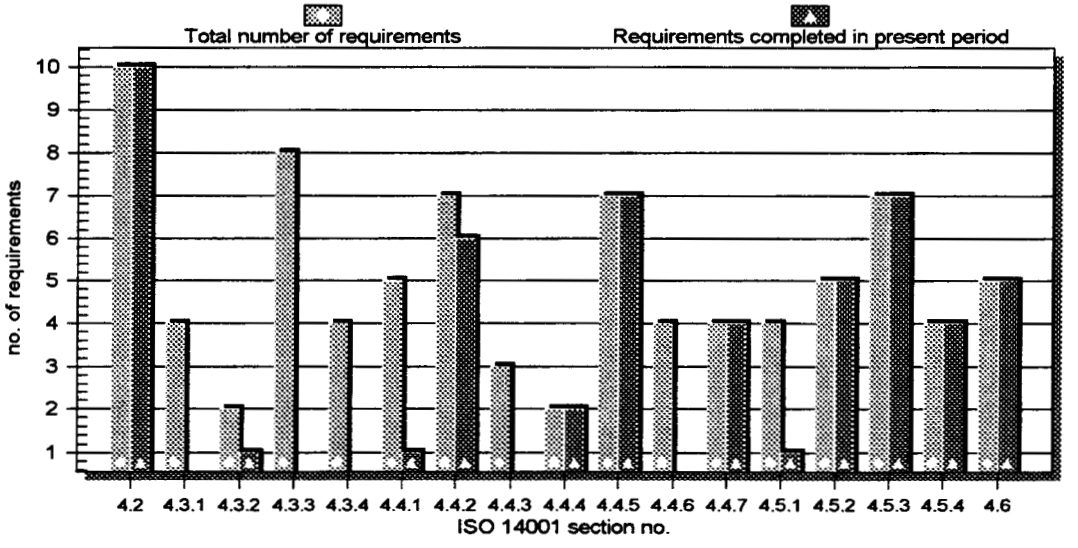
The purpose of this report is to summarize the status of White Sands Test Facility's environmental management system with respect to meeting the requirements of ISO 14001.

The review of White Sands Test Facility's environmental management system is divided into three main sections. Section II, "Gap Analysis," analyzes the results of White Sands Test Facility's assessment and automatically provides a status report on the organization's performance with respect to meeting each requirement of ISO 14001. Section III, "Recommended Actions," identifies the actions that White Sands Test Facility will need to take to meet the requirements of ISO 14001. Section IV provides the estimated net cost for White Sands Test Facility's to become ISO 14001 certified.

Figure 1 compares by ISO section the total number of requirements currently over 80% met by White Sands Test Facility against the total number of requirements in ISO 14001.

Figure 1
Summary of ISO 14001 performance results



This section provides a comparative analysis of the White Sands Test Facility environmental management system with respect to how it addresses each of the requirements of ISO 14001.

4.2 ENVIRONMENTAL POLICY

4.2 Environmental policy

Checklist reference: **4.2.10**

The environmental policy is crucial for establishing an overall sense of direction and identifying the parameters of action for White Sands Test Facility. It also forms the basis for setting White Sands Test Facility's objectives and targets and provides the impetus for implementation and ongoing improvement of the environmental management system. Top management policy is defined by NASA Headquarters.

Environmental policy requirements	>80% met	20-80% met	<20% met
• top management must define the environmental policy	X		
• top management must ensure that the environmental policy is appropriate to the nature, scale and environmental impacts of the organization's activities, products or services	X		
• top management must ensure that the environmental policy includes a commitment to continual improvement and prevention of pollution	X		
• top management must ensure that the environmental policy includes a commitment to comply with relevant environmental legislation and regulations, and with other requirements to which the organization subscribes	X		
• top management must ensure that the environmental policy provides the framework for setting and reviewing environmental objectives and targets	X		
• top management must ensure that the environmental policy is documented to all employees	X		
• top management must ensure that the environmental policy is implemented by all employees	X		
• top management must ensure that the environmental policy is maintained by all employees	X		
• top management must ensure that the environmental policy is communicated to all employees	X		
• top management must ensure that the environmental policy is available to the public	X		

4.3 PLANNING

4.3.1 Environmental aspects

Checklist reference: **4.3.11**

The purpose of identifying environmental aspects is to determine which aspects have or can have significant environmental impacts. Significant aspects then define the program's operational controls. They are also considered in setting objectives and targets.

Environmental aspects requirements	>80% met	20-80% met	<20% met
• establish (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• maintain (a) procedure(s) to identify the environmental aspects of the organization's activities, products or services that it can control and over which it can be expected to have an influence in order to determine those which have or can have significant impacts on the environment			X
• ensure that the aspects related to the significant impacts are considered in setting the organization's environmental objectives			X
• ensure that the information on the organization's environmental aspects and significant environmental impacts is kept up-to-date			X

4.3.2 Legal and other requirements

Checklist reference: **4.3.21**

White Sands Test Facility must have in place procedures for identifying and accessing all the legal and other requirements that apply to the environmental aspects of its activities, products and services.

Legal and other requirements	>80% met	20-80% met	<20% met
• establish a procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services		X	
• maintain the procedure to identify and have access to legal and other requirements to which the organization subscribes that are applicable to the environmental aspects of its activities, products or services	X		

4.3.3 Objectives and targets

Checklist reference: **4.3.31**

Establishing objectives and targets is the next major step in implementing the environmental management system.

Objectives and targets requirements	>80% met	20-80% met	<20% met
• establish documented environmental objectives and targets at each relevant function and level within the organization			X
• maintain documented environmental objectives and targets at each relevant function and level within the organization			X
• consider the organization's legal and other requirements when establishing and reviewing its objectives			X
• consider the organization's significant environmental aspects when establishing and reviewing its objectives			X
• consider the organization's technological options when establishing and reviewing its objectives			X
• consider the organization's financial, operational and business requirements when establishing and reviewing its objectives			X
• consider the views of interested parties when establishing and reviewing its objectives			X
• ensure that the organization's objectives and targets are consistent with its environmental policy, including the commitment to prevention of pollution			X

4.3.4 Environmental management program(s)

Checklist reference: **4.3.41**

White Sands Test Facility's environmental management program(s) should describe how its objectives and targets will be achieved and should include identifying responsibilities, procedures and timing.

Environmental management program(s) requirements	>80% met	20-80% met	<20% met
• establish and maintain (a) program(s) for achieving the organization's objectives and targets			X
• include in the program(s) the designation of responsibility for achieving objectives and targets at each relevant function and level of the organization			X
• include in the program(s) the means and time-frame by which the objectives and targets are to be achieved			X
• amend the program(s) where relevant to ensure that environmental management applies to projects relating to new developments and new or modified activities, products or services			X

4.4 IMPLEMENTATION AND OPERATION

4.4.1 Structure and responsibility

Checklist reference: **4.4.11**

White Sands Test Facility must define the roles, responsibilities and authorities in its environmental management system to ensure successful implementation of the system. Management must allocate resources appropriately to implement and control the system, and top management must appoint specific management representatives.

Structure and responsibility requirements	**>80% met**	**20-80% met**	**<20% met**
• define and document the roles, responsibilities and authorities in order to facilitate effective environmental management		**X**	
• communicate the roles, responsibilities and authorities in order to facilitate effective environmental management			X
• ensure that management provides resources essential to the implementation and control of the environmental management system, including human resources and specialized skills, technology and financial resources	X		
• ensure that top management appoints (a) specific management representative(s) who, irrespective of other responsibilities, have defined roles, responsibilities and authorities for ensuring that environmental management system requirements are established, implemented and maintained in accordance with the ISO 14001 standard			X
• ensure that the specific management representative(s) appointed by top management have defined roles, responsibilities and authorities for reporting on the performance of the environmental management system to top management for review and as a basis for improvement of the environmental management system			X

4.4.2 Training, awareness and competence

Checklist reference: **4.4.21**

White Sands Test Facility must identify its training needs and ensure that all personnel whose work may have a significant environmental impact are trained appropriately. This requires ensuring that these personnel are competent in terms of their education, training and/or experience.

Training, awareness and competence requirements	**>80% met**	**20-80% met**	**<20% met**
• identify training needs			X
• require that all personnel whose work may create a significant impact upon the environment have received appropriate training	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the importance of conformance with the environmental policy and procedures and with the requirements of the environmental management system	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the actual or potential significant environmental impacts of their work activities and the environmental benefits of improved personal performance	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of their roles and responsibilities in achieving conformance with the environmental policy and procedures and with the requirements of the environmental management system, including emergency preparedness and response requirements	X		
• establish and maintain procedures to make the organization's employees or members at each relevant function and level aware of the potential consequences of departure from specified operating procedures	X		
• ensure that personnel performing the tasks which can cause significant environmental impacts are competent in terms of appropriate education, training and/or experience	X		

4.4.3 Communication

Checklist reference: **4.4.31**

White Sands Test Facility must establish and maintain procedures for internal and external communication about its environmental aspects and environmental management system.

Communication requirements	>80% met	20-80% met	<20% met
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for internal communication between the various levels and functions of the organization			X
• with regard to the organization's environmental aspects and environmental management system, establish and maintain procedures for receiving, documenting and responding to relevant communication from external interested parties			X
• consider processes for external communication on the organization's significant environmental aspects and record its decision			X

4.4.4 Environmental management system documentation

Checklist reference: **4.4.41**

White Sands Test Facility's environmental management system documentation must be sufficient to describe the core elements of its environmental management system and should be integrated with the documentation of its other systems.

White Sands Test Facility has met all of the requirements for this section of ISO 14001.

Environmental management system documentation requirements	>80% met	20-80% met	<20% met
• establish and maintain information, in paper or electronic form, to describe the core elements of the organization's management system and their interaction	X		
• establish and maintain information, in paper or electronic form, to provide direction to related information	X		

4.4.5 Document control

Checklist reference: **4.4.51**

Proper control and management of documents are critical to the successful implementation of an environmental management system, and White Sands Test Facility's documentation control procedures therefore should be effective and efficient.

Document control requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the documents can be located	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that they are periodically reviewed, revised as necessary and approved for adequacy by authorized personnel	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that the current versions of relevant documents are available at all locations where operations essential to the effective functioning of the environmental management system are performed	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that obsolete documents are promptly removed from all points of issue and points of use, or otherwise assured against unintended use	X		
• establish and maintain procedures for controlling all documents required by the ISO 14001 standard to ensure that any obsolete documents retained for legal and/or knowledge preservation purposes are suitably identified	X		
• ensure that documentation is legible, dated (with dates of revision) and readily identifiable, maintained in an orderly manner and retained for a specified period	X		
• establish and maintain procedures and responsibilities concerning the creation and modification of the various types of document	X		

4.4.6 Operational control

Checklist reference: **4.4.61**

The purpose of establishing proper operational controls is to ensure that White Sands Test Facility's environmental policy, objectives and targets are met. In this regard, White Sands Test Facility must identify the operations and activities associated with its significant environmental aspects consistent with its policy, objectives and targets. It also must plan these activities to ensure that they are carried out.

Operational control requirements	**>80% met**	**20-80% met**	**<20% met**
• identify those operations and activities that are associated with the identified significant environmental aspects in line with the organization's policy, objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining documented procedures to cover situations where their absence could lead to deviations from the environmental policy, and objectives and targets		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by stipulating operating criteria		X	
• plan the activities associated with the identified significant environmental aspects, including maintenance, to ensure that they are carried out under specified conditions by establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and services used by the organization and communicating relevant procedures and requirements to suppliers and contractors		X	

4.4.7 Emergency preparedness response

Checklist reference: **4.4.71**

Emergency preparedness and response procedures must be established and maintained in order to identify the potential for and respond to emergencies and accidents, and to prevent or minimize their environmental impacts.

Emergency preparedness response requirements	>80% met	20-80% met	<20% met
• establish and maintain procedures to identify the potential for and respond to accidents and emergency situations	X		
• establish and maintain procedures to prevent and mitigate environmental impacts that may be associated with accidents and emergency situations	X		
• review and revise, where necessary, the organization's emergency preparedness and response procedures, particularly after the occurrence of accidents or emergency situations	X		
• periodically test the organization's emergency preparedness and response procedures where practicable	X		

4.5 CHECKING AND CORRECTIVE ACTION

4.5.1 Monitoring and measurement

Checklist reference: **4.5.11**

White Sands Test Facility must establish and maintain documented procedures for regularly monitoring and measuring the key characteristics of its operations and activities that can significantly impact the environment. This includes documenting performance tracking information, relevant operational controls and conformance with its environmental objectives and targets.

Monitoring and measurement requirements	>80% met	20-80% met	<20% met
• establish and maintain documented procedures to monitor and measure, on a regular basis, the key characteristics of the organization's operations and activities that can have a significant impact on the environment		X	
• ensure that the organization's procedures to monitor and measure include the recording of information to track performance, relevant operational controls and conformance with its environmental objectives and targets		X	
• ensure that monitoring equipment is calibrated and maintained and that records of this process are retained according to its procedures	X		
• establish and maintain a documented procedure for periodically evaluating compliance with relevant environmental legislation and regulations		X	

4.5.2 Non-conformance, corrective and preventive action

Checklist reference: **4.5.21**

White Sands Test Facility must establish and maintain procedures for addressing nonconformances, mitigating environmental impacts and taking corrective and preventive actions.

Nonconformance, corrective and preventive action requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for defining responsibility and authority for handling and investigating nonconformance	X		
• establish and maintain procedures for taking action to mitigate any impacts caused	X		
• establish and maintain procedures for initiating and completing corrective and preventive action	X		
• ensure that any corrective or preventive action taken to eliminate the causes of actual and potential nonconformances is appropriate to the magnitude of problems and commensurate with the environmental impact encountered	X		
• implement and record any changes in the documented procedures resulting from corrective and preventive action	X		

4.5.3 Records

Checklist reference: **4.5.31**

White Sands Test Facility must establish and maintain procedures for its environmental records, including training records and audit and review results, to the extent appropriate to demonstrate its conformance to the requirements of ISO 14001.

Records requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain procedures for the identification of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the maintenance of environmental records, including training records and the results of audits and reviews	X		
• establish and maintain procedures for the disposition of environmental records, including training records and the results of audits and reviews	X		
• ensure that the environmental records are legible, identifiable and traceable to the activity, product or service involved	X		
• ensure that the environmental records are stored and maintained such that they are readily retrievable and protected against damage, deterioration or loss	X		
• ensure that the retention times for the environmental records are established and recorded	X		
• ensure that the environmental records are maintained, as appropriate to the system and to the organization, to demonstrate conformance to the requirements of the ISO 14001 standard	X		

4.5.4 Environmental management system audit

Checklist reference: **4.5.41**

White Sands Test Facility must establish and maintain programs and procedures for periodically conducting audits of its environmental management system. These are necessary to evaluate the system performance in terms of meeting ISO 14001 requirements and to provide information about audit results to management.

Environmental management system audit requirements	**>80% met**	**20-80% met**	**<20% met**
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to determine whether or not the environmental management system conforms to planned arrangements for environmental management including the ISO 14001 requirements, and that the environmental management system is properly implemented and maintained	X		
• establish and maintain (a) program(s) and procedures for periodic environmental management system audits to be carried out, in order to provide information on the results of audits to management	X		
• ensure that the audit program, including any schedule, is based on the environmental importance of the activity concerned and on the results of previous audits	X		
• ensure that, in order to be comprehensive, the audit procedures cover the audit scope, frequency and methodologies, as well as the responsibilities and requirements for conducting audits and reporting results	X		

4.6 Management review *Checklist reference:* **4.6.10**

White Sands Test Facility's management must periodically assess the continuing suitability, adequacy and effectiveness of its environmental management system. This documented and comprehensive review must ensure the collection of information necessary for the evaluation. It also must address the potential need to make changes to various aspects of the system based on the audit results, changing circumstances and management's commitment to continual improvement.

Management review requirements	**>80% met**	**20-80% met**	**<20% met**
• top management must determine the intervals at which it will review the environmental management system	X		
• top management must review the environmental management system to ensure its continuing suitability, adequacy and effectiveness	X		
• ensure that the management review process has collected the necessary information to allow management to carry out the evaluation	X		
• the management review must be documented	X		
• the management review must address the possible need for changes to the policy, objectives and other elements of the environmental management system, in light of environmental management system audit results, changing circumstances and the commitment to continual improvement	X		

This section identifies and prioritizes major recommended actions for White Sands Test Facility to meet the requirements of the various sections of ISO 14001 as identified in the corresponding checklists.

Recommended Actions to Meet ISO 14001 Requirements

4.3.1 Environmental aspects
Checklist reference: **4.3.11**
1. Establish procedures for environmental aspects and identify aspects.

4.3.2 Legal and other requirements
Checklist reference: **4.3.21**
1. Need to review EPA and NEPA documentation to identify all legal requirements.

4.3.3 Objectives and targets
Checklist reference: **4.3.31**
1. Once significant aspects have been identified specific objectives and targets need to be established.

4.3.4 Environmental management program
Checklist reference: **4.3.41**
1. Following establishment of objectives and targets, means need to be established to meet objectives and targets.

4.4.1 Structure and responsibility
Checklist reference: **4.4.11**
1. Complete WSP22-0014 on structure and responsibility for environmental program.

4.4.2 Training, awareness and competence
Checklist reference: **4.4.21**
1. Establish a training needs matrix.
2. Provide EMS awareness training to all site personnel.

4.4.3 Communication
Checklist reference: **4.4.31**
1. Establish formal procedures for internal and external EMS communications.
2. Ensure all site personnel are aware of and understand the EMS.

Recommended Actions to Meet ISO 14001 Requirements

4.4.4 EMS documentation
Checklist reference: 4.4.41
1. Need an EMS manual to tie the program together.

4.4.5 Document Control
Checklist reference: 4.4.5.1
1. Identify environmental documents to control
2. Roll into ISO 9000 document control
3. Include process for review and approval of all documents.

4.4.6 Operational control
Checklist reference: 4.4.61
1. There are many activities at WSTF that require operational control procedures. Some have been developed; 17 need to be completed. Need to tie to objectives and targets.

4.5.1 Monitoring and measurement
Checklist reference: 4.5.11
1. Most equipment already under calibration control. Two procedures under development for monitoring the EMS.

4.5.2 Non-conformance, corrective and preventive action
Checklist reference: 4.5.21
1. Incorporate ISO 9000 procedures into the EMS.

4.5.3 Records
Checklist reference: 4.5.31
1. General records kept in office. Other specific records kept by environmental staff
   A) Develop procedure
   B) Consolidate records.

4.5.4 Environmental management system audit
Checklist reference: 4.5.41
1. Modify EPA protocol audits to address ISO 14001.
2. Conduct EMS audit.

4.6 Management review
Checklist reference: 4.6.10
1. Incorporate ISO 9000 procedures into the EMS program.

White Sands Test Facility

Section III identifies the net costs associated with developing implementing, registering, and maintaining the EMS for each of the three models presented in the Business Case.

Major Task Areas	*Alt. 2 Costs*	*Alt. 3 Costs*	*Alt. 4 Costs*
Developing the EMS	[1] $50,000 [2]	[1] $35,000 [2]	[1] $35,000 [2]
Implementing the EMS	[1] $75,000 [2]	[1] $75,000 [2]	[1] $50,000 [2]
Registering the EMS	$60,000 [3] $10,000 [2]	$60,000 [3] $10,000 [2]	$60,000 [3] $10,000 [2]
Total Costs through Registration =	**$195,000** **No Net FTE Costs**	**$180,000** **No Net FTE Costs**	**$155,000** **No Net FTE Costs**
Annual Maintenance Costs	$20,000 [3] $25,000 [2] No Net FTE Costs	$20,000 [3] $25,000 [2] No Net FTE Costs	$20,000 [3] $25,000 [2] No Net FTE Costs

EXPLANATION of COSTS

[1] Because WSTF is contractor operated, there are no net FTE costs to NASA.

[2] Estimated contractor costs, i.e, contracted training, materials, and contractor assistance.

[3] Estimated registration fees.